EXPERIMENTS ON CATTLE PLAGUE.

CARRIED OUT FOR THE COMMISSION NOMINATED BY DECISION
OF THE COUNCIL OF MINISTERS, DATED CAIRO,
APRIL 13, 1912.

BY

CHARLES TODD, M.D., AND R. G. WHITE, M.B.

(From the Hygienic Institute, Department of Public Health, Cairo.)

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INTRODUCTION.

In view of the continued prevalence of Cattle Plague in Egypt, a Commission was nominated by decision of the Council of Ministers, dated April 13, 1912, under the Presidency of His Excellency the late Birch Pacha, the following being the terms of reference :—

. . . *d'étudier toutes les questions se rattachant à la Peste Bovine, de rechercher les meilleurs moyens de combattre les ravages de cette maladie, de procéder à toute expérience jugée nécessaire et de présenter des rapports sur les mesures préventives qu'elle jugera utile de prendre à cet égard.*

The authors, who were both members of the Commission, were asked to draw up a provisional programme of the necessary experimental investigation. The Commission was of the opinion that these investigations should be directed—at any rate in the first instance—to certain points having an important bearing on the practical measures necessary for dealing with the epidemic, and various members suggested questions which, in their opinion, urgently called for investigation in this connection. These questions were as follows :—

(1) Does Cattle Plague exist in such a benign form amongst the Egyptian or Sudanese cattle that it cannot be clinically diagnosed, and are buffaloes more especially subject to this form of the disease, so becoming "carriers" of the contagion and playing an important rôle in carrying on the disease ?

(2) The natural means of conveyance of the infection. Infectivity of nasal discharge, urine, fæces, meat, hides, etc.

(3) The times of incubation of the disease in different classes of cattle (buffaloes, etc.).

(4) How long does the meat (fresh and frozen) of an infected animal remain infective ?

(5) How long does the hide of an infected animal remain infective under various circumstances (*e.g.* when dried, salted, etc.) and what are the best methods of disinfecting hides ?

(6) How long does an animal remain infective after recovery from the naturally acquired disease ?

(7) How long does an animal remain infective after simultaneous inoculation ?

(8) The duration of passive immunity after injection of serum and its relation to the dose of serum injected.

(9) If an animal is repeatedly injected with serum, do the injections become useless or even harmful ?

(10) On the duration of infection in stables (on dried *tibn*), etc.

Attention was devoted primarily to these points, and in order to avoid unnecessary delay, a short progress report was handed to the President on October 26, 1912.

Pending the preparation of the detailed report, an abstract of the results of the experimental inquiry, so far as they relate to the above questions, was presented to the Commission on March 19, 1914.

This abstract consisted merely of brief answers to the questions, so far as was possible from the information available (*vide* Appendix).

After the regrettable death of the President, H.E. Birch Pasha, the Commission was suspended on December 9, 1912, by order of H.E. the Minister of the Interior.

The Commission having held eighteen meetings during the period of April 19 to November 30, 1912, and having submitted two reports dealing mainly with the administrative side of the question, the writers were authorized to carry on the experimental work already commenced and, as a scientific Sub-Committee, were granted the necessary funds for the continuation of the work until March 31, 1914, the termination of the financial year. The following report embodies the results obtained up to this date.

Our knowledge of the ætiology of Cattle Plague, based on exact experimental work, is singularly incomplete. The reason for this is obvious when we consider the conditions under which such work has always had to be undertaken. The serious nature of the disease, and the enormous losses which it may cause, naturally prevent its introduction into clean countries purely for the purpose of investigation; so that it can only be studied in districts already infected.

Apart from the fact that during an epidemic of Cattle Plague neither time nor staff is, as a rule, available for scientific investigations, other difficulties arise. In the first place, it is not easy to obtain regular supplies of highly susceptible cattle, as many of the animals which are available may have already passed through an attack of the disease, so being immune and hence useless for experimental purposes. Again, even if a supply of susceptible cattle is available, there is a constant risk of their accidentally contracting the disease.

The first of these difficulties was especially troublesome in Egypt; the local cattle, owing to their irregular susceptibility, being found to be quite unsuitable. In order to overcome this, a regular supply of cattle was obtained from Cyprus, and for some years proved most satisfactory, practically no case of immunity being met with; there was also a remarkable absence of Texas fever and of other protozoal infections. During the last year, however, apparently owing to some change in the conditions or source of supply in Cyprus, much difficulty has been met with; some of the animals proving immune to Cattle Plague and a large proportion showing Texas fever parasites in their blood on arrival in Cairo.

Another difficulty with the freshly imported clean cattle was the risk of their infection with the piroplasmata of Texas and Egyptian fevers,* shortly after their arrival in the country. Such infection can hardly be avoided, as these diseases are endemic in Egypt, and it is practically impossible, at any rate during the summer months, to protect the imported animals from ticks.

Other diseases also may give rise to trouble, for example, foot-and-mouth disease, an outbreak of which in the present instance caused complete stoppage of the experimental work for a considerable period.

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* The term "Egyptian Fever" is used for a disease of cattle, endemic in Egypt, which is caused by a piroplasm closely resembling, if not identical with, that of Trans-Caucasian fever.

Experiments on the ætiology and means of transmission of Cattle Plague present certain difficulties due to the conditions under which these experiments must necessarily be carried out. Owing to the highly infectious nature of the disease it is not possible to carry on many experiments at the same time ; as there must always be a considerable risk of accidental infection if any large number of infected and non-infected animals are brought into the same experimental areas, unless special precautions are taken. The unavoidable handling of the animals, necessitated by the taking of temperatures, etc., affords ample facility for the occurrence of cross infection ; especially in a country like Egypt, where the attendants are more or less untrained *fellahîn.* The impossibility of doing more than one or two experiments simultaneously considerably retards the progress of such experimental work.

Similar difficulties have been met with elsewhere, and Lingard in a "Report on the Preparation of Rinderpest Protective Serum" refers to these in India as follows :—

" Any one looking over the report, and not being particularly interested in the results arrived at, might consider that a period of over four years was rather a long one, and perhaps unnecessarily so for producing results such as are now indicated. But when it is recognized that the two small figures 30 c.c., indicating protective value per 600 lbs. body weight of any serum for hill animals, may have taken a period of three to six months to work out, utilizing several or many susceptible animals in the process, when no indications were forthcoming by which a clue to the true dose necessary in each case, respectively, could be obtained, the time is certainly not a long one. Even now the *absolute* dose has seldom been specified in hill animals, the actual amount being 2 or 3 c.c. either way, for in every animal experimented with the susceptibility varied somewhat, and it would be a difficult matter to find any two possessing identical susceptibility."

Without laying undue stress on the difficulties referred to above, it is important that these should be carefully borne in mind in planning any scheme for the experimental investigation of the disease.

Fortunately the existence of an Institute for the preparation of Cattle Plague serum on a large scale, in the immediate vicinity of Cairo, enabled the experimental work of the Commission to be begun at once and to be carried out very much more economically and satisfactorily than would have been possible had it been necessary to erect and staff a special experimental station.

This Institute, which is situated about four miles from the centre of Cairo, contains accommodation for 450 animals, which are used for the preparation of Cattle Plague serum. The method employed is that of Kolle and Turner, with some modifications to suit the conditions of the country, the technique being briefly as follows :—

Clean susceptible cattle are inoculated with a small quantity of virulent Cattle Plague blood, and after a short incubation period they contract a severe attack of the disease. When this is at its height they are bled to death, and the virulent blood so obtained, after the addition of citrate of soda to prevent clotting, is used for the treatment of the animals designed for the production of serum. For this purpose healthy Egyptian cattle are taken and given simultaneous inoculations of 1 c.c. of virulent blood on one side of the body and a suitable dose of serum on the other side. These injections are followed by a modified attack of the disease, from which, if the dose of serum has been properly chosen, the animal recovers. After complete recovery and when the temperature is normal, a massive dose of four litres of the virulent blood is injected intramuscularly. This again is followed by a febrile reaction, after the termination of which another dose of four litres of virulent blood is given.

A fortnight after the last injection the animal is bled—five litres being taken from the jugular vein. Three such bleedings, at intervals of a fortnight, are made, and then another dose of four litres of virulent blood given and the process repeated. The blood thus taken is allowed to clot and the serum decanted, centrifugalized, and bottled.

For the production of the virulent blood required for this process clean cattle are imported weekly from the Island of Cyprus. They are brought up to Cairo in disinfected railway trucks and kept strictly isolated either on the desert or in a stable about half a mile from the Institute. These animals are taken to the Institute as required and inoculated with virulent blood; six days after inoculation they are bled to death from the carotid artery.

The carrying out of the experiments of the Commission in connection with the work of the Institute presented great advantages, as a constant supply of virulent material was always available and the blood of such animals as developed Cattle Plague in the course of the experiments was not lost but could generally be utilized at the Serum Institute. This latter point is of great importance, as otherwise the cost of the animals required would have been almost prohibitive.

On the other hand, the necessity of keeping the experimental animals in comparatively close proximity to an intensely infected area was undoubtedly a disadvantage, but the risks were minimized by erecting a considerable number of small isolated matting stables on the desert outside the limits of the Institute. These stables were designed to hold two animals each, so that if necessary a control could be placed with the experimental animal. After each experiment the stables were disinfected by spraying with lysol and flooding the floor with the same solution and were then left exposed to the sun and air for at least a week. This method of disinfection was repeatedly tested by placing clean susceptible cattle in the disinfected stables and was found to be thoroughly satisfactory. Each stable had its own set of utensils: buckets, brushes, etc., and a pail of disinfecting solution was placed at the door. Special arrangements were made for the watering, feeding, etc., of the cattle under experiment. Every possible precaution was taken to eliminate the risk of accidental infection by means of the personnel. The oldest and most trustworthy attendants were put in charge of the animals, and as far as possible, one man was detailed for each experiment. Each man was given clean clothing and during the course of the experiment lived and slept in the stable. In short, no obvious precaution which would hinder the possibility of accidental infection was omitted, but one is only too acutely aware of the impossibility of elaborating any system for the complete prevention of such occurrences, especially in an Oriental country.

This is a point which must not be overlooked in the interpretation of results obtained, as negative results must necessarily be of greater value than those in which infection occurs.

The report of these experiments, which were directed to certain points in the ætiology of the disease bearing on practical measures, is far from complete and the authors feel the necessity for further work on many points. The time which could be spared from other duties was, however limited, and the experiments were only rendered possible by the able assistance accorded by the staff of the Serum Institute. We would particularly refer to the help which we have received from Mr. A. De R. Gordon, M.R.C.V.S., Director of the Serum Institute, who has not only carried out and supervized a large number of the experiments, but whose clinical knowledge and valuable criticism has always been at our disposal. The same applies to Mr. G. A. Roberts, M.R.C.V.S., Veterinary Inspector.

We are indebted to Mr. Littlewood, Chief Veterinary Inspector, for the services of Mohamed Effendi Askar, Director of Cairo Abattoir, who took the keenest personal interest in the work and was responsible for the control and records of the experiments.

EXPERIMENTS ON CATTLE PLAGUE.

I.—LOCALIZATION IN THE ANIMAL BODY AND PROPERTIES OF THE VIRUS.

It is generally held that in an animal suffering from Cattle Plague all parts of the organism are infective: the blood, lymph, tears, saliva, urine, milk, fæces, etc., all contain the virus.

BLOOD.

Infectivity of.

The infectivity of the blood in Cattle Plague was first definitely established in 1866 by the English Royal Commission appointed to inquire into the origin and nature of Cattle Plague. The importance attached by the members of the Commission to this discovery of Dr. Burdon Sanderson is summed up in the following quotation from their report:—

"Coincident with the first elevation of temperature, and, of course, long before there is the least outward appearance of ill-health, the blood of an animal which has taken the Cattle Plague contains an agent which can produce the plague in another animal. In other words, the earliest fact which can be made out after infection is, that the blood contains the poison of the disease, so that serum obtained from it will give the disease by inoculation. This fact, ascertained by Dr. Sanderson, is the most important pathological discovery yet made in Cattle Plague. . . . The poison contained in a minute portion of the mucous discharge from the eyes and mouth of an animal ill with Cattle Plague, if placed in the blood of a healthy animal, increases so fast that in less than forty-eight hours, perhaps in a far shorter time, the whole mass of blood, weighing many pounds, is infected, and every small particle of that blood contains enough poison to give the disease to another animal."

In 1897, Koch, in his early attempts to transmit the disease by means of excretions from diseased animals, found that the results were either uncertain or that the disease was from the start complicated with sepsis; he therefore tried the blood of infected animals, and in his early experiments, on inoculating five animals in the dew-lap with infected blood, they all contracted the disease after a period of incubation lasting from three to five days. All observers agree that at the height of the disease the blood is very infective. Koch found that 1/500th c.c. of Cattle Plague blood injected subcutaneously into cattle gave Rinderpest after the same period of incubation as 10 c.c. and with the same symptoms. Kohlstock found that 1/1000th c.c. of Cattle Plague blood gave the disease, but the animal showed no symptoms until the twelfth day after inoculation and died on the sixth day of the disease. He notes the possibility of an accidental infection.

Nicolle states that one drop of blood invariably produces the disease in susceptible animals, and in a later paper he notes that 1/60th c.c. was sufficient to produce the disease.

As the result of some thousands of inoculations carried out on Cyprus bulls in Cairo in connection with the preparation of Anti-Rinderpest serum, it can be stated with certainty that the blood is invariably highly infective on the sixth day after inoculation.

Appearance of infectivity of.

In order to determine how soon the blood becomes virulent after the inoculation of a small quantity of virulent blood, Cyprus cattle were inoculated subcutaneously with 1/50th c.c. each of virulent blood and their blood was tested at intervals of twenty-four hours. The blood was found to remain non-infective for the first seventy-two hours, and as a rule became infective during the course of the succeeding twenty-four, the appearance of the infectivity of the blood coinciding with the rise of temperature. This is absolutely in accordance with the results obtained in 1865 by Dr. Burdon Sanderson, who proved that as soon as the rise in temperature was observed in a beast infected with Rinderpest the blood of that animal became capable of communicating the disease to a healthy beast when injected under the skin.

This was later confirmed by Koch.

A series of tests carried out at the Serum Institute, Cairo, to determine the minimum amount of the blood of an animal suffering from Cattle Plague (seventh day) which would convey the disease by subcutaneous inoculation showed that the amount varied between 1/500th and 1/2000th c.c.

Non-infectivity of, by means of mucous membranes.

In the course of the experiments in Cairo much trouble was experienced from the presence of piroplasmic infections (Texas and Egyptian fevers); as both these diseases are endemic in Egypt and are often lit up by the inoculation of virulent Cattle Plague blood, it was difficult to obtain virulent Cattle Plague blood free from piroplasmata. In order to get rid of this difficulty attempts were made to infect clean animals by smearing the nostrils with Cattle Plague blood. These attemptsh, owever, failed, and directed attention to the important fact that the active agent of Cattle Plague as it exists in the blood is apparently not directly infective by means of the nasal mucous membrane. This appeared so important that a large number of experiments were instituted to settle the point, the results of which will be seen in the following table.

TABLE No. 1.—**Experiments to determine the Infectivity of Cattle Plague Blood when applied to Nasal Mucous Membranes.**

No. of Experiment.	No. of Animal.	DATE.	NATURE OF EXPERIMENT.	RESULT.	REMARKS.
23	1840 $\frac{3}{3}$	24.6.12	Nostrils swabbed with virulent blood.	**Negative.**	Afterwards tested and found to be susceptible.
23	1841 $\frac{4}{4}$	24.6.12	Nostrils swabbed with virulent blood.	**Negative.**	Afterwards tested and found to be susceptible.
28	1896	8.7.12	Nostrils swabbed with virulent blood.	**Negative.**	Afterwards tested and found to be susceptible.
108	2266	11.1.13	Nostrils swabbed with virulent blood.	**Negative.**	Afterwards tested and found to be susceptible.
108	2267	11.1.13	Nostrils swabbed with virulent blood.	**Negative.**	Afterwards tested and found to be susceptible.
108	2268	11.1.13	Nostrils swabbed with virulent blood.	**Negative.**	Afterwards tested and found to be susceptible.

TABLE No. 1 (*continued*).

No. of Experiment.	No. of Animal.	DATE.	NATURE OF EXPERIMENT.	RESULT.	REMARKS.
108	2269	11.1.13	Nostrils swabbed with virulent blood.	**Negative.**	Afterwards tested and found to be susceptible.
108	2270	11.1.13	Nostrils swabbed with virulent blood.	**Negative.**	Afterwards tested and found to be immune.
108	2271	11.1.13	Nostrils swabbed with virulent blood.	**Negative.**	Afterwards tested and found to be susceptible.
108	2274	11.1.13	Nostrils swabbed with virulent blood.	**Negative.**	Afterwards tested and found to be susceptible.
108	2275	11.1.13	Nostrils swabbed with virulent blood.	**Negative.**	Afterwards tested and found to be susceptible.
140	2451	16.3.13	Nostrils swabbed with virulent blood.	**Negative.**	*See below.*
140	2473	16.3.13	Nostrils swabbed with virulent blood.	**Negative.**	
140	2479	16.3.13	Nostrils swabbed with virulent blood.	**Negative.**	
140	2451	23.3.13	Nostrils swabbed more freely with virulent blood.	**Negative.**	Afterwards tested with virulent blood and found to be susceptible.
140	2473	23.3.13	Nostrils swabbed more freely with virulent blood.	**Positive.**	Rise of temperature after 5×24 hours.
140	2479	23.3.13	Nostrils swabbed more freely with virulent blood.	**Positive.**	Rise of temperature after 4½×24 hours.

It will be seen that the results were negative except in those cases in which the nostrils were very freely smeared.

In this process it is obviously impossible to exclude the swallowing of a certain amount of the blood and it was therefore necessary to investigate the effect of the virulent blood when given by the mouth.

Infectivity of, by mouth.

Some experiments on this point by Baldrey in India would appear to show that virulent blood in doses of 0·5 c.c. by the mouth does not produce the disease, as the only animal in his experiments which developed Cattle Plague did so after an incubation period of fifteen days. In order to establish this point for the disease as it exists in Egypt, a number of animals were given virulent blood diluted in saline or water in the form of a drench as follows :—

TABLE NO. 2.—**Experiments to determine the Infectivity of Cattle Plague Blood when given by the Mouth.**

No. of Experiment.	No. of Animal.	DATE.	NATURE OF EXPERIMENT.	RESULT.	REMARKS.
57	1962	21. 8.12	Drenched with 1 c.c. virulent blood in 1 litre of saline solution.	**Negative.**	Afterwards tested with virulent blood and found to be susceptible.
98	2037	23.10.12	Drenched with 1 c.c. virulent blood in ½ litre of water.	**Complicated.**	The rise of temperature took place on the evening of the day on which the drench was given. Accidental infection.
120	2400	9. 2.13	Drenched with 1 c.c. virulent blood in ½ litre of water.	**Negative.**	Afterwards tested with virulent blood and found to be susceptible.
120	2401	9. 2.13	Drenched with 1 c.c. virulent blood in ½ litre of saline solution.	**Positive.**	Rise of temperature after 5½×24 hours.
46	1936	7. 8.13	Drenched with 5 c.c. virulent blood in 1 litre of saline solution.	**Positive.**	Rise of temperature after 5½×24 hours.
99	2143	23.10.12	Drenched with 5 c.c. virulent blood in ½ litre of water.	**Complicated.**	Rise of temperature after 7½×24 hours. Possibility of accidental infection.
121	2402	9. 2.13	Drenched with 5 c.c. virulent blood in ½ litre of water.	**Positive.**	Rise of temperature after 4½×24 hours. Showed typical signs of Cattle Plague and recovered.
121	2403	9. 2.13	Drenched with 5 c.c. virulent blood in ½ litre of saline solution.	**Negative.**	Afterwards tested with virulent blood, had a mild reaction and recovered.
39	1927	25. 7.12	Drenched with 500 c.c. virulent blood.	**Positive.**	Rise of temperature after 4×24 hours.

Omitting the two cases where there was a possibility of accidental infection, of the three animals which received 1 c.c. of blood only one contracted the disease ; of the three animals receiving 5 c.c., two contracted the disease, as also did the animal receiving 500 c.c.

It thus appears that virulent blood infects somewhat easily by the alimentary canal—the minimum dose being about 1 c.c. This would explain the infection in the two cases where the nostrils were liberally smeared with infected blood, and it is highly probable that a purely nasal contact with virulent blood does not infect.

In order to eliminate the question of gastro-intestinal infection, experiments were made by swabbing the vagina with virulent blood in the case of three cows. In all these the results were negative.

TABLE No. 3.—**Experiments to determine the Infectivity of Cattle Plague Blood when applied to the Vaginal Mucous Membrane.**

No. of Experiment.	No. of Animal.	DATE.	NATURE OF EXPERIMENT.	RESULT.	REMARKS.
207	2823	6.7.13	Vagina swabbed freely with the blood of a 6th morning Cattle Plague animal.	**Negative.**	Afterwards tested and found to be susceptible.
209	2837	17.7.13	Vagina swabbed with virulent blood.	**Negative.**	Afterwards tested with virulent blood and found to be susceptible.
209	2840	17.7.13	Vagina swabbed with virulent blood.	**Negative.**	Afterwards tested with virulent blood and found to be susceptible.

From the above experiments it appears that the active agent of Cattle Plague, as it exists in the blood, is incapable of infecting by the uninjured nasal or vaginal mucous membranes, at any rate in reasonable doses.

This non-infectivity of the blood by contact with mucous membranes appears to have entirely escaped observation, and Nicolle and Adil Bey state that animals may be easily infected by swabbing their mucous membranes with blood. The fact, however, seems to have been unconsciously observed, for, in dealing with epidemics in South Africa, Spreull, who is quoted by Hutcheon, states that in immunising clean herds it had been the habit to mix serumised animals at once with sick ones, and that where this was done "for any length of time" the results were excellent. Sick cattle, however, being often unobtainable, he resorted to smearing the nostrils of the cattle with virulent blood at the moment of inoculation; this he found to be a very unreliable method, the infection often entirely failing or only a few animals turning sick ten days or so after.

Infectivity of, by conjunctivæ.

It is interesting to note, on the other hand, that virulent blood dropped into the conjunctival sac appears to infect with some ease. The conjunctivæ of two bulls were smeared with virulent blood. Both animals developed Cattle Plague after a period of five days.

TABLE No. 4.—**Experiments to determine the Infectivity of Cattle Plague Blood when applied to the Conjunctivæ.**

No. of Experiment.	No. of Animal.	DATE.	NATURE OF EXPERIMENT.	RESULT.	REMARKS.
74	2030	19.9.12	Eyes smeared with virulent blood.	**Positive.**	Rise of temperature after 5½×24 hours.
37	2465	12.3.13	Eyes smeared with virulent blood.	**Positive.**	Rise of temperature after 5½×24 hours.

Intra-venous injection of.

Both Kolle and Nicolle & Adil Bey found that if a small dose of virulent blood is inoculated into a vein, it does not always cause infection. In an experiment carried out by Kolle two animals each received into the ear vein 1 c.c. of virulent blood; in one case the blood went completely into the vein and neither infection nor immunity resulted, in the other case some of the blood escaped under the skin and the animal developed the disease.

Nicolle and Adil Bey were inclined to attribute the non-infection of animals by the intra-venous injection of small quantities of virulent blood to the fact that the virus is immediately diluted by the large mass of the blood. They showed, however, that infection may take place after the intra-venous injection of quite small quantities of virulent blood, even when the site of inoculation is immediately sterilized with the thermo-cautery.

Memmo, Martoglio, and Adani found that intra-venous inoculation of virulent blood invariably caused a typical and fatal attack of the disease.

Duration of infectivity of.

As regards the period for which the blood of an animal remains infective after an attack of Cattle Plague or after simultaneous inoculation, very few data exist in the literature. It seems to be the general opinion that the existence of the virus in the blood practically coincides with the period of fever. Some experiments made in Cairo before the formation of the Commission tended to confirm this : in one animal which had had a period of fever lasting for thirteen days, the blood tested on the twelfth day of the fever was found to be virulent. In another animal the blood was found to be non-virulent twenty-four hours after the subsidence of the reaction. The blood of several animals tested at later periods was also non-virulent. These experiments were not continued, as the question of the infectivity of the discharges was considered more important in relation to the practical question of the spread of the disease. The investigation of the infectivity of the discharges is gone into in considering the methods of the transmission of the disease.

Relation of virus to blood cells.

Kolle in 1899 found that if defibrinated virulent blood is centrifugalized for twenty to thirty minutes in a high speed centrifuge at 2,000 to 3,000 revolutions per minute, the supernatant clear fluid is quite non-infective, while the corpuscular sediment contains the virus. The results of this experiment, coupled with the fact that the virus, as contained in the blood, did not pass either the Berkefeld or Chamberland filter, even after hæmolysis of the red blood corpuscles by 0·2 per cent saline, induced Kolle to believe that the causal organism of Cattle Plague must be of sufficient size to be visible, when some method of staining has been discovered which will differentiate it from the corpuscles and serum.

Nicolle and Adil Bey in 1902, in their third memoir on Cattle Plague, conclude that the virus is probably intra-leucocytic, the following being the main reasons for their opinion :—

(1) The virus, which never gives any local lesion at the point of inoculation, does not show at its secondary localizations anything suggesting that it develops free in the body fluids.

(2) Fluids poor in formed elements, such as cerebro-spinal fluid, aqueous humour, etc., are much less infectious than fluids rich in these elements, such as the blood.

(3) Kolle's centrifuging experiment, referred to above.

(4) The fact that fluids containing no red blood corpuscles, such as aqueous humour and cerebro-spinal fluid, are virulent.

Baldrey in 1911, at Muktesar, defibrinated and centrifugalized virulent blood; the resulting serum was hæmoglobin stained, and gave Cattle Plague at a dose of 1·0 c.c. Serum, when obtained by allowing the virulent blood to clot and stand in the ice-safe, was quite clear, with no hæmolysis. At a dose of 1·0 c.c. it gave neither Cattle Plague nor immunity. Baldrey concludes that " the virulence of Rinderpest is contained in the red corpuscles and is not free in the plasma, providing no hæmolysis has taken place." He refers to Theiler's statement, quoted by Friedberger and Fröhner, that serum does not contain any virulent material.

The following experiment, carried out in this investigation, probably explains Baldrey's results :—

Citrated virulent blood was centrifugalised for half an hour at a high speed in Martin's water centrifuge. 1·0 c.c. of the clear supernatant fluid was injected into a Cyprus bull; this animal developed typical Cattle Plague, the temperature rising on the fourth evening. In order to control this result a second experiment was carried out, and after centrifugalizing citrated virulent blood in the same way, the clear supernatant plasma was pipetted off into clean centrifuge tubes and was again centrifugalised for an hour. After this second centrifugalization, the examination of the tubes with a hand lens showed a very small but quite definite sediment of blood cells. This undoubtedly explains the positive results of the first experiment, as two bulls, each inoculated with 1·0 c.c. of the supernatant plasma from the second centrifugalization, gave no reaction.

This result emphasises the risk of drawing conclusions from any experiments on centrifugalizing such materials as blood, unless adequate precautions have been taken to prevent the disturbance of the superficial layer of the sediment by the swirl of the currents naturally set up in the buckets during the stoppage of the machine.

Following upon the above results, the plasma having been found to give a negative result, attention was directed to the sediment. Attempts were made to fractionate this by means of repeated centrifugalizations as follows :—

Half a litre of citrated virulent blood was centrifugalized for about an hour and the greater part of the clear supernatant plasma pipetted off and kept for later use. The upper layers of the cell-deposit, together with the remaining plasma, were then pipetted off and again centrifugalized in a smaller machine. This process of pipetting off the upper layers and centrifugalizing was repeated until a creamy white layer, consisting almost entirely of white blood corpuscles and platelets, was obtained.

It was found that this result could be best attained by about seven centrifugalizings, and by making use of the citrated plasma obtained from the first stage, instead of saline, for the re-washings.

In a similar way, but by taking the bottom layer of cells from the centrifuge tubes, the red blood corpuscles were obtained in a state of comparative purity.

The relative virulence of the two layers so prepared was now tested on animals.

TABLE No. 5.—**Experiments with Centrifugalized Virulent Blood.**

No. of Experiment.	No. of Animal.	DATE.	NATURE OF EXPERIMENT.	RESULT.	REMARKS.
32	1886	10.7.12	Inoculated subcutaneously with 5 c.c. Bottom layer.	**Positive.**	Rise of temperature after 4×24 hours.
32	1885	10.7.12	Inoculated subcutaneously with 0·5 c.c. Bottom layer.	**Positive.**	Rise of temperature after 6×24 hours.
32	1857	10.7.12	Inoculated subcutaneously with 0·05 c.c. Bottom layer.	**Negative.**	Afterwards tested with virulent blood and found to be susceptible.
32	1884	10.7.12	Inoculated subcutaneously with 0·5 c.c. Top layer.	**Positive.**	Rise of temperature after 3×24 hours.
32	1859	10.7.12	Inoculated subcutaneously with 0·05 c.c. Top layer.	**Positive.**	Rise of temperature after 3½×24 hours.
32	1900	10.7.12	Inoculated subcutaneously with 0·005 c.c. Top layer.	**Positive.**	Rise of temperature after 4½×24 hours.
32	1856	10.7.12	Inoculated subcutaneously with 0·0005 c.c. Top layer.	**Negative.**	Afterwards tested with virulent blood and found to be susceptible.

These results show that whereas ½ c.c. of the red cell layer was necessary to produce the disease, 1/200th c.c. of the leucocytic cream gave the same result, *i.e.* the concentration of the virus in the leucocytic layer is a hundred times as great as in the red cell layer.

This experiment was repeated, another sample of virulent blood being treated in the same way and the cell layers separated as in the former experiment. Dilutions were then inoculated into fresh cattle.

TABLE No. 6.—**Experiments with Centrifugalized Virulent Blood.**

No. of Experiment.	No. of Animal.	DATE.	NATURE OF EXPERIMENT.	RESULT.	REMARKS.
201	2763	24.6.13	Inoculated subcutaneously with 1 c.c. of the citrated plasma of virulent blood.	**Negative.**	Afterwards tested with virulent blood and found to be susceptible.
201	2764	24.6.13	Inoculated subcutaneously with 1 c.c. of the citrated plasma of virulent blood.	**Negative.**	Afterwards tested with virulent blood and found to be susceptible.
197	2701	5.6.13	Inoculated subcutaneously with 5 c.c. Bottom layer.	**Positive.**	Rise of temperature after 4×24 hours.
197	2699	5.6.13	Inoculated subcutaneously with 0·5 c.c. Bottom layer.	**Positive.**	Rise of temperature after 5×24 hours.
197	2700	5.6.13	Inoculated subcutaneously with 0·05 c.c. Bottom layer.	**Negative.**	Afterwards tested with virulent blood and found to be susceptible.
197	2709	5.6.13	Inoculated subcutaneously with 0·5 c.c. Top layer.	**Positive.**	Rise of temperature after 4×24 hours.
197	2708	5.6.13	Inoculated subcutaneously with 0·05 c.c. Top layer.	**Positive.**	Rise of temperature after 3×24 hours.
197	2710	5.6.13	Inoculated subcutaneously with 0·005 c.c. Top layer.	**Positive.**	Rise of temperature after 4×24 hours.
197	2703	5.6.13	Inoculated subcutaneously with 0·0005 c.c. Top layer.	**Doubtful.**	Afterwards tested with virulent blood and found to be immune.

From this it will be seen that the results of the second test are practically identical with those of the first, and leave no doubt that the causal agent, as it exists in the blood, is not in the red cells but comes down in the layer containing the leucocytes and blood platelets.

Theoretically it should be possible to carry on this fractionation until the red cell layer is completely deprived of virulence, but in practice it is found that after repeated centrifugalizations the leucocytic layer tends to form a viscid sticky mass, rendering further separation difficult, if not impossible.

Conservation of virulence of.

The statements made in the literature as to the period after which Cattle Plague blood loses its virulence when kept in vitro are very conflicting. Nocard states that this takes place after four to six weeks at ordinary temperatures, but he notes that drying causes a rapid sterilization and that the influence of light is doubtless considerable.

According to Woronzoff and Ekkert, blood placed on damp paper, and enclosed in well-corked bottles buried in the ground, was found to be still infective after seven days.

Semmer states that blood sealed in glass tubes remains virulent for several months.

Rogers found that in an atmosphere of hydrogen or air, virulent blood keeps its virulence for twenty days at room temperature, but under both conditions it lost all virulence when kept at 37° C. for ten days.

Kohlstock found that defibrinated blood gave the disease after keeping for twenty days in the dark at the laboratory temperature.

Two leeches fed by Nicolle and Adil Bey on an infected animal were found to be infectious after sixteen days. The same observers injected 1·0 c.c. of virulent blood into the dorsal lymph sac of a frog, but the blood tested fifteen days later was non-virulent.

In their second paper on Cattle Plague, Nicolle and Adil Bey state that blood, defibrinated or not, and kept in a small pipette, rapidly loses its infectivity (six to seven days in the ice-safe and three to four days at room temperature in summer). Blood defibrinated or citrated (0·3 per cent), kept in a volume of 200 c.c., remains virulent for at least twelve days at 15° C. to 16° C. 1·0 c.c. of defibrinated blood, incorporated with 5 c.c. of gelatine and kept in the ice-safe, was virulent after thirty-two days and non-virulent after sixty days. Mixed with gelatine and kept in the incubator, it loses its virulence in from four to six days.

Stockman says that in the plains of India blood from a sick ox could not be depended upon to keep its virulence for more than forty-eight hours, even when kept in the ice-chest, and states in a footnote that the experience in South Africa was the same.

Most of the authors quoted above give very few exact details as to the conditions under which the blood was kept, though some of these details, such as the temperature, are obviously highly important in determining the period of conservation of virulence.

From the point of view of the spread of the disease the period of time for which blood retains its virulence at ordinary temperature is not of great moment and, as will be referred to later, liquid blood probably plays no part in the transmission of the infection under natural conditions.

In any scheme, however, for the simultaneous inoculation of a large number of animals, especially where these are scattered over a large area, the problem of conserving the virulence of Cattle Plague blood becomes one of great importance, and in view of Stockman's statement quoted above, referring to the difficulties in keeping virulent blood more than forty-eight hours, even in the ice-safe, both in South Africa and in India, it was thought well to devote some attention to this point. For this purpose a clean animal was inoculated with 1 c.c. of virulent blood ; six days later he was bled to death into a solution of neutral sodium citrate, the amount of citrate being 0·5 per cent of the total volume of the blood. This citrated blood was then placed in test-tubes and sealed, each test-tube containing about 40 c.c. These tubes were kept in a cold room at a constant temperature of -6° C. to -7° C. At intervals of a week a clean animal was inoculated with 5 c.c. of the contents of one of the tubes.

In the first experiment made the blood was found to be virulent for the first five weeks. After this period, owing to the occurrence of Texas Fever and immunity to Cattle Plague amongst the Cyprus animals used for the tests, the results became uncertain, and it was thought advisable to repeat the whole experiment as soon as satisfactory animals were available for testing. Eight months later this was done, and the blood was tested at intervals of a week for the first ten weeks, and then at intervals of a fortnight up to twenty-two weeks. All the animals inoculated developed Cattle Plague.

At the end of this test only one tube of virulent blood remained and this was tested after twenty-nine weeks. The inoculated animal developed a mild but typical attack of the disease and recovered, but the incubation period was very long, as the first rise of temperature did not take place until ten days after the inoculation. As the isolation of the experimental animal was very strict, there was no reason to suspect an accidental infection, though this is, of course, always possible. The mildness of the attack may have been due either to a certain amount of immunity in the animal or to some attenuation of the virus.

Omitting this result, however, as uncertain, it appears that in blood kept at a temperature of -6° C. to -7° C. the virulence is retained for a period of at least twenty-two weeks.

An interesting point was noted in connection with these experiments, namely, that the animal inoculated with the "cold-stored" blood developed the disease as a rule after a longer incubation period than animals receiving ordinary virulent blood. When this was first observed, the possibility of an accidental infection was naturally considered, and in the succeeding tests still more rigorous precautions were taken to eliminate any such possibility. The inoculated animal in each case was kept in an isolated stable far removed from any possible source of infection and with a separate attendant. In several cases a clean Cyprus bull was placed in the stable with the injected animal and allowed to remain with him for several days. In no case did these control animals contract the disease.

The following table shows the incubation period in the animals receiving the "cold-stored" blood.

The animals were inoculated subcutaneously with 5 c.c. of the virulent blood after it had been kept at -6° C. to -7° C. for different periods.

TABLE No. 7.—Experiments with Virulent Blood (Cold Storage).

No. of Experiment.	No. of Animal.	DATE.	TIME OF COLD STORAGE.	RESULT.	REMARKS.
154	2522	7. 4.13	1 Week	Positive.	Rise of temperature after 4×24 hours.
162	2554	14. 4.13	2 Weeks	Positive.	Rise of temperature after 4×24 hours.
164	2577	22. 4.13	3 „	Positive.	Rise of temperature after 4½×24 hours.
175	2609	29. 4.13	4 „	Positive.	Rise of temperature after 5×24 hours.
181	2620	5. 5.13	5 „	Positive.	Rise of temperature after 4×24 hours.
184	2635	12. 5.13	6 „	Positive.	Rise of temperature after 7½×24 hours.
190	2661	19. 5.13	7 „	Positive.	Rise of temperature after 6½×24 hours.
193	2681	26. 5.13	8 „	Positive.	Rise of temperature after 7½×24 hours.
196	2692	2. 6.13	9 „	Positive.	Rise of temperature after 6½×24 hours.
199	2730	10. 6.13	10 „	Positive.	Rise of temperature after 5½×24 hours.
200	2791	23. 6.13	12 „	Positive.	Rise of temperature after 7×24 hours.
202	2770	30. 6.13	13 „	Positive.	Rise of temperature after 5×24 hours.
208	2794	7. 7.13	14 „	Positive.	Rise of temperature after 5½×24 hours.
210	2859	23. 7.13	16 „	Positive.	Rise of temperature after 10½×24 hours.
211	2860	29. 7.13	17 „	Positive.	Rise of temperature after 9½×24 hours.
216	2918	14. 8.13	19 „	Positive.	Rise of temperature after 6½×24 hours.
223	2967	8. 9.13	22 „	Positive.	Rise of temperature after 6½×24 hours.
236	3042	19.10.13	29 „	Positive.	Rise of temperature after 9½×24 hours.

This table shows that, excluding the animals inoculated with blood less than six weeks old and the animal which was inoculated with twenty-nine weeks old blood and recovered, the average incubation period was seven days, with a minimum of five days and a maximum of ten and a half days; whereas the average incubation period of animals inoculated with fresh virulent blood is three days, with a minimum of about two and a maximum of about five.

The conservation of the virulence of blood at 0° C. is being determined, but the experiments are not yet completed. It can, however, be stated that virulent blood kept at 0° C. in melting ice retains its virulence for at least a fortnight.

Effect of heat, etc., on virus.

The virulence of Cattle Plague blood is easily destroyed by heating. Baldrey found that, while virulent blood heated at 45° C. for thirty minutes was still virulent, heating for the same time at a temperature of 59° C. or more completely destroyed its virulence. Animals inoculated with such blood, rendered non-virulent by heat, acquired no immunity.

All observers appear to agree that drying causes a rapid sterilization of virulent blood. Nocard states that blood dried in a thin layer is sterilized after two hours when exposed to the sun at a temperature of 34° C.

Koch found that 10 c.c. of virulent blood dried at 31° C. for four days, dissolved in water and inoculated, proved non-virulent and did not immunize.

Rogers found that Rinderpest blood dried in a thin layer in sterilized Petri dishes at 37° C. (which process took about twenty-four hours), then dissolved in sterilized saline and injected subcutaneously, was non-virulent and produced no immunity.

Koch diluted virulent blood with distilled water in the proportion of one part of blood to twenty of water and found that the dilution still infected an animal. He notes that the incubation period was long, but that the disease had a fatal termination.

Koch states that Rinderpest blood mixed with glycerine in varying concentrations is rendered non-virulent, and notes that this fact is remarkable, as almost all infective materials, particularly vaccine lymph, are not destroyed by glycerine, but are even preserved by it.

LYMPH.

Beyond the simple statement that the lymph of an animal suffering from Cattle Plague is virulent, the literature appears to contain no further information.

In order to investigate this question a series of experiments was undertaken with fresh lymph taken from the thoracic duct.

In the course of the work at the Serum Institute animals are regularly killed on the seventh day of the disease, being bled to death in order to obtain the virulent blood. In such animals immediately after death, on freely opening up the thoracic and abdominal cavities, it was found comparatively easy to isolate the thoracic duct near the point of entry to the vein, and on inserting a fine glass tube and gently massaging the duct in an upward direction, it was not difficult to obtain a supply of fresh sterile lymph.

Two animals were inoculated subcutaneously with 0·5 c.c. and 2 c.c. of the lymph so obtained. In both cases Cattle Plague resulted, the initial rise of temperature occurring after two and a half and four days respectively.

TABLE No. 8.—**Experiments to determine the Infectivity of Cattle Plague Lymph when inoculated subcutaneously.**

No. of Experiment.	No. of Animal.	DATE.	NATURE OF EXPERIMENT.	RESULT.	REMARKS.
233	3003	24.9.13	Inoculated subcutaneously with 0·5 c.c. lymph of a Cattle Plague animal.	**Positive.**	Rise of temperature after 2½×24 hours.
234	3006	25.9.13	Inoculated subcutaneously with 2 c.c. lymph of a Cattle Plague animal.	**Positive.**	Rise of temperature after 4×24 hours.

In order to determine the degree of virulence of the lymph a series of animals was inoculated with dilutions of the fresh lymph obtained from the thoracic duct of a bull killed on the seventh day after inoculation with virulent blood.

TABLE No. 9.—**Experiments to determine the Degree of Virulence of Cattle Plague Lymph.**

No. of Experiment.	No. of Animal.	DATE.	NATURE OF EXPERIMENT.	RESULT.	REMARKS.
240	3109	8.11.13	Inoculated subcutaneously with 1/10th c.c. lymph of a Cattle Plague animal.	**Positive.**	Rise of temperature after 4½×24 hours.
240	3107	8.11.13	Inoculated subcutaneously with 1/30th c.c. lymph of a Cattle Plague animal.	**Positive.**	Rise of temperature after 7×24 hours.
240	3106	8.11.13	Inoculated subcutaneously with 1/100th c.c. lymph of a Cattle Plague animal.	**Negative.**	Afterwards tested with virulent blood and found to be susceptible.
240	3104	8.11.13	Inoculated subcutaneously with 1/300th c.c. lymph of a Cattle Plague animal.	**Negative.**	Afterwards tested with virulent blood and found to be susceptible.
240	3103	8.11.13	Inoculated subcutaneously with 1/1000th. c.c. lymph of a Cattle Plague animal.	**Negative.**	Afterwards tested with virulent blood and found to be susceptible.

It was found that 1/30th c.c. of the lymph was sufficient to produce the disease, but that 1/100th c.c. or less did not produce infection.

In order to test the infective power of lymph applied to the mucous membranes, three experiments were made by smearing the nostrils. The result of these experiments was uncertain, and for various reasons—more particularly the risk of complication by swallowing, referred to above in connection with virulent blood—it was thought advisable to repeat these experiments on cows *per vaginam.*

Two animals had several drops of lymph dropped directly into the vagina and in both cases infection resulted, the initial rise occurring after four and four and a half days.

TABLE No. 10.—**Experiments to determine the Infectivity of Cattle Plague Lymph when applied to Mucous Surfaces.**

No. of Experiment.	No. of Animal.	DATE.	NATURE OF EXPERIMENT.	RESULT.	REMARKS.
225	2999	10.9.13	Vagina swabbed with lymph of a Cattle Plague animal.	**Positive.**	Rise of temperature after 4½×24 hours.
228	3008	11.9.13	Vagina swabbed with lymph of a Cattle Plague animal.	**Positive.**	Rise of temperature after 4×24 hours.

FLESH.

On testing the virulence of the juice of fresh Cattle Plague meat, it was found that subcutaneous inoculation into susceptible animals produces the disease in the same way as the inoculation of Cattle Plague blood or other virulent material.

TABLE No. 11.—**Experiments to determine the Infectivity of the Flesh of Animals suffering from Cattle Plague.**

No. of Experiment.	No. of Animal.	DATE.	NATURE OF EXPERIMENT.	RESULT.	REMARKS.
49	1939	7.8.12	Inoculated subcutaneously with 5 c.c. fresh Cattle Plague meat emulsion.	**Positive.**	Rise of temperature after 4×24 hours.
122	2396	12.2.13	Inoculated subcutaneously with 10 c.c. fresh Cattle Plague meat emulsion made from an animal which had been bled to death on the eighth morning after nose smear with nasal discharge.	**Positive.**	Rise of temperature after 4×24 hours.
148	*2505	31.3.13	Inoculated subcutaneously with 5 c.c. fresh Cattle Plague meat emulsion made as above described.	**Positive.**	Rise of temperature after 4×24 hours.

Whereas swabbing the nostrils or vagina of an animal with the juice does not infect.

TABLE No. 12.—**Experiments to determine the Infectivity of the Flesh of Animals suffering from Cattle Plague.**

No. of Experiment.	No. of Animal.	DATE.	NATURE OF EXPERIMENT.	RESULT.	REMARKS.
48	1937	7. 8.12	Nostrils swabbed with fresh Cattle Plague meat emulsion from a Cyprus bull which had been bled to death on the sixth day after inoculation with virulent blood.	**Negative.**	Afterwards tested with virulent blood and found to be susceptible.
238	3064	30.10.13	Vagina swabbed with fresh Cattle Plague meat emulsion made as above described.	**Negative.**	Afterwards tested with virulent blood and found to be susceptible.

In a further experiment a piece of Cattle Plague meat was placed in the manger of a susceptible animal, allowed to remain for twenty-four hours, and renewed every day for four days. It was noted that the animal chewed the meat.

He developed the disease four and a half days after the meat was first placed in the manger, the infection apparently taking place by means of the alimentary canal. Thus the juice of Cattle Plague meat appears to behave in the same way as virulent blood.

In order to determine how long the meat of a Cattle Plague animal remains virulent, a series of experiments was undertaken by keeping the flesh of an animal, killed on the seventh day after inoculation of virulent blood, at the following temperatures: (1) At -6° C. to -7° C.; (2) at 13° C.; (3) at 28° C.

(1) Cold storage at -6° C. to -7° C.

Apart from its theoretical interest, this is a point which has an important practical bearing, in view of the export of frozen meat from countries possibly infected with the disease, and a large number of experiments were made on meat so treated and kept for various periods up to nine weeks under these conditions.

For convenience of handling, cubes of the fresh meat, of about one kilogramme each, were placed separately in tin boxes. These were enclosed in a larger tin box, which was locked and sent to the refrigerating chamber of a Cold Storage Company and kept under the same conditions as the meat supplied by the Company.

At intervals of about a week one of the small tin boxes was brought to the laboratory, and the meat which was frozen hard was allowed to thaw at room temperature, and after being passed through a mincing machine and moistened with normal saline, the juice was extracted in a meat press; 5 c.c. of this juice was injected into a susceptible animal. The meat so kept was tested up to a period of nine weeks as follows:—

TABLE No. 13.—**Experiments to determine the Infectivity of the Flesh of Animals suffering from Cattle Plague (Cold-Storage).**

No. of Experiment.	No. of Animal.	DATE.	TIME IN COLD STORAGE.	RESULT.	REMARKS.
53	1954	15. 8.12	1 Week	Negative.	Afterwards tested with virulent blood and found to be susceptible.
59	1969	21. 8.12	2 Weeks	Negative.	Afterwards tested with virulent blood and found to be susceptible.
62	1988	28. 8.12	3 „	Negative.	Afterwards tested with virulent blood and found to be susceptible.
69	1999	4. 9.12	4 „	Negative.	Afterwards tested with virulent blood and found to be susceptible.
86	2059	2.10.12	6 Days	Positive.	Rise of temperature after 5×24 hours.
91	2072	9.10.12	13 „	Positive.	Rise of temperature after 3×24 hours.
96	2102	16.10.12	20 „	Negative.	Afterwards tested with virulent blood and found to be susceptible.

TABLE No. 13 (*continued*).

No. of Experiment.	No. of Animal.	DATE.	NATURE OF EXPERIMENT.	RESULT.	REMARKS.
124	2432	28.2.13	15 Days	Negative.	Afterwards tested with virulent blood and found to be susceptible.
132	2451	5.3.13	3 Weeks	Negative.	Afterwards tested with virulent blood and found to be susceptible.
155	2525	7.4.13	1 Week	Negative.	Afterwards tested with virulent blood and found to be susceptible.
161	2553	14.4.13	2 Weeks	Negative.	Afterwards tested with virulent blood and found to be susceptible.
165	2574	24.4.13	3 "	Negative.	Afterwards tested with virulent blood and found to be susceptible.
174	2608	29.4.13	4 "	Positive.	Rise of temperature after 4½×24 hours. Possibility of accidental infection.
180	2618	5.5.13	5 "	Negative.	Afterwards tested with virulent blood and found to be susceptible.
183	2634	12.5.13	6 "	Negative.	Afterwards tested with virulent blood and found to be susceptible.
189	2660	19.5.13	7 "	Negative.	Afterwards tested with virulent blood and found to be susceptible.
194	2683	26.5.13	8 "	Negative.	Afterwards tested with virulent blood and found to be susceptible.
195	2691	2.6.13	9 "	Negative.	Afterwards tested with virulent blood and found to be susceptible.

If we exclude experiment No. 174, in which there was a definite risk of accidental infection, the longest period of storage after which the meat was found to be virulent was thirteen days, but the loss of virulence may take place earlier, as in two cases it was found to be non-virulent after one week.

It would appear from this that the risk of the transmission of the disease to other countries by the export of frozen meat need not be seriously taken into consideration, more especially when one considers that the juice of the meat is not infective by mere contact.

(2) At 13° C.

As these experiments were being carried out during the summer in Cairo at a time when the laboratory temperature was about 28° C., in order to more closely similate European conditions pieces of Cattle Plague meat were hung in one of the laboratory ice-safes, where the temperature was found to be fairly constant at 13° C. At the end of twenty-four and forty-eight hours the pieces of the meat were minced, squeezed in a press and 5 c.c. of the resulting juice inoculated into two animals. In both cases it was found to be virulent.

TABLE NO. 14.—**Experiments to determine the Infectivity of the Flesh of Animals suffering from Cattle Plague.**

No. of Experiment.	No. of Animal.	DATE.	NATURE OF EXPERIMENT.	RESULT.	REMARKS.
9	5	28.5.12	Flesh kept at 13° C. for 24 hours: 5 c.c. of the resulting fluid after the above treatment was inoculated subcutaneously.	**Positive.**	Rise of temperature after $5\frac{1}{4}\times24$ hours.
15	11	12.6.12	Flesh kept at 13° C. for 48 hours: 5 c.c. of the resulting fluid inoculated subcutaneously.	**Positive.**	Rise of temperature after 3×24 hours.

(3) At 28° C.

Pieces of meat were hung in a laboratory cupboard where the temperature was 28° C. and tested after twenty-four and forty-eight hours as in the previous experiment. In both cases the meat proved to be virulent.

TABLE NO. 15.—**Experiments to determine the Infectivity of the Flesh of Animals suffering from Cattle Plague.**

No. of Experiment.	No. of Animal.	DATE.	NATURE OF EXPERIMENT.	RESULT.	REMARKS.
10	10	28.5.12	Flesh kept at 28° C. for 24 hours: 5 c.c. of the resulting fluid after the above treatment was inoculated subcutaneously.	**Positive.**	Rise of temperature after $4\frac{1}{2}\times24$ hours.
16	12	12.6.12	Flesh kept at 28° C. for 48 hours: 5 c.c. of the resulting fluid inoculated subcutaneously.	**Positive.**	Rise of temperature after $3\frac{1}{2}\times24$ hours.

The virulence of the meat at ordinary temperatures was not tested after keeping for longer than forty-eight hours, as this has no practical importance in a climate where putrefaction takes place so rapidly.

The fact that Cattle Plague meat and meat juice are not directly infective by means of the mucous membranes has a very important bearing on administrative prophylactic measures. In Egypt, on the outbreak of Cattle Plague in a village, it can be confidently asserted that the first cases are never notified to the authorities. As soon as the animals become seriously ill their throats are cut and the meat is sold in the district, and it is only when the meat supply becomes inconveniently large that the disease is notified. Hitherto the distribution of infected meat has been regarded as one of the commonest means of the distribution of the disease. The foregoing experiments show that this is not the case, and that the meat proper probably plays no rôle in the transmission of the disease. It must be remembered, however, that this statement only refers to the flesh and not to the viscera, for it has been found that scrapings from some of the internal organs readily transmit the disease by the ordinary methods of contact. This question is gone into in detail below.

In connection with the infectivity of Cattle Plague animals, the question of the edibility of the flesh of these animals may be referred to.

In spite of statements to the contrary, the flesh of cattle suffering from Cattle Plague, at any rate during the early stages of the disease, gives rise to no unpleasant symptoms in man, and for the last eighteen months the flesh of the Cyprus animals, which are regularly killed at the Serum Institute for the production of virulent blood, has been regularly consumed by the staff of the Institute, numbering about fifty men.

ORGANS.

As the most characteristic and often the only lesions of Cattle Plague are met with in the fourth stomach, more particularly at the pyloric end, attention is naturally directed to this organ.

Mucous membrane of stomach.

In the following experiments the stomachs of animals suffering from Cattle Plague, which had been bled to death for virulent blood, were taken. The mucous surface of the fourth stomach, especially the congested region around the pylorus, was carefully washed and then scraped, and an emulsion made by grinding the scrapings in a mortar with glass powder, with the addition of saline solution.

The result of inoculating this emulsion showed that the material is very highly virulent.

Table No. 16.—**Experiments to determine the Infectivity of Stomach Scrapings, when Inoculated Subcutaneously.**

No. of Experiment.	No. of Animal.	Date.	Nature of Experiment.	RESULT.	Remarks.
D	838	21.10.08	Inoculated subcutaneously with stomach scrapings.	**Positive.**	Rise of temperature after 3×24 hours.
E	845	27.10.08	Inoculated subcutaneously with stomach scrapings.	**Positive.**	Rise of temperature after 2½×24 hours.
F	850	31.10.08	Inoculated subcutaneously with stomach scrapings.	**Positive.**	Rise of temperature after 2½×24 hours.
G	853	2.11.08	Inoculated subcutaneously with stomach scrapings.	**Positive.**	Rise of temperature after 2½×24 hours.
H	854	2.11.08	Inoculated subcutaneously with stomach scrapings.	**Positive.**	Rise of temperature after 3×24 hours.
I	863	8.11.08	Inoculated subcutaneously with stomach scrapings.	**Positive.**	Rise of temperature after 2×24 hours.
J	1330	15. 3.10	Inoculated subcutaneously with stomach scrapings.	**Positive.**	Rise of temperature afrer 2½×24 hours.
24	22	25. 6.12	Inoculated subcutaneously with stomach scrapings.	**Positive.**	Rise of temperature after 2½×24 hours.
24	24	25. 6.12	Inoculated subcutaneously with stomach scrapings.	**Positive.**	Rise of temperature after 3×24 hours.

The above nine animals inoculated with the emulsion all developed the disease, the first rise of temperature occurring after two days in one animal, after two and a half days in five animals, and after three days in three animals.

A very striking fact is that the emulsion, unlike blood, is directly infective by contact with the mucous membranes. Two bulls whose nostrils were smeared with the emulsion both developed the disease, as did a cow whose vagina was swabbed with the same fluid.

TABLE NO. 17.—**Experiments to determine the Infectivity of Stomach Scrapings, when applied to Mucous Surfaces.**

No. of Experiment.	No. of Animal.	DATE.	NATURE OF EXPERIMENT.	RESULT.	REMARKS.
25	1887	3. 7.12	Nostrils swabbed with stomach scrapings.	**Positive.**	Rise of temperature after 5×24 hours.
25	1888	3. 7.12	Nostrils swabbed with stomach scrapings.	**Positive.**	Rise of temperature after 5×24 hours.
241	3146	17.11.13	Vagina swabbed with stomach scrapings.	**Positive.**	Rise of temperature after 6½×24 hours.

In making experiments by injecting animals with emulsions of the various organs of Cattle Plague infected animals, it was practically impossible to avoid the presence of a certain amount of blood, even though the animal had been bled to death; and as we know that the inoculation of Cattle Plague blood, even in small doses, almost inevitably gives the disease, the results of such experiments are almost always positive.

In order to overcome this difficulty, advantage was taken of the fact that the causal agent of Cattle Plague, as it exists in the blood, is not directly infective by means of the nasal and vaginal mucous membranes, and experiments were made to see whether emulsions of the more important organs could convey the disease in this manner.

Liver.

Three animals had their nostrils smeared with the scrapings of the liver of a Cattle Plague animal killed on the seventh day of the disease. These three bulls all developed Cattle Plague, the initial rise of temperature taking place in each case five days after the smearing of the nostrils. In order to eliminate the possibility of swallowing of the infective material, a fourth experiment was made on a cow whose vagina was swabbed with an emulsion of the liver. This beast also contracted the disease, the temperature beginning to rise four days after the swabbing.

TABLE No. 18.—Experiments to determine the Infectivity of the Liver of Cattle Plague Animals.

No. of Experiment.	No. of Animal.	DATE.	NATURE OF EXPERIMENT.	RESULT.	REMARKS.
136	2440	12.3.13	Nostrils swabbed with Cattle Plague liver.	**Positive.**	Rise of temperature after 5½×24 hours.
217	2908	17.8.13	Nostrils swabbed with scrapings from the liver of a Cattle Plague animal.	**Positive.**	Rise of temperature after 5½×24 hours.
217	2909	17.8.13	Nostrils swabbed with scrapings from the liver of a Cattle Plague animal.	**Positive.**	Rise of temperature after 5½×24 hours.
227	3007	10.9.13	Vagina swabbed with scrapings of a Cattle Plague liver.	**Positive.**	Rise of temperature after 3½×24 hours.

Spleen.

The spleen, being an organ containing a large proportion of blood, naturally produces the disease when inoculated subcutaneously in the form of an emulsion.

The following two experiments show that emulsions of spleen pulp are also capable of producing the disease, when applied to the nasal and vaginal mucous membranes:—

TABLE No. 19.—Experiments to determine the Infectivity of the Spleen of Cattle Plague Animals.

No. of Experiment.	No. of Animal.	DATE.	NATURE OF EXPERIMENT.	RESULT.	REMARKS.
142	2488	22. 3.13	Nostrils swabbed with two pieces of spleen of an animal (sixth day after inoculation with virulent blood.)	**Positive.**	Rise of temperature after 3½×24 hours.
239	3066	30.10.13	Vagina swabbed with an emulsion made of the spleen of an animal (sixth day after inoculation with virulent blood.)	**Positive.**	Rise of temperature after 4½×24 hours.

Lymphatic glands.

From the fact that the lymph is infective by simple contact with the mucous membranes, it might be inferred that this would hold good for emulsions of the various lymphatic glands. This proved to be the case in the following experiments :—

Table No. 20.—**Experiments to determine the Infectivity of Lymphatic Glands by means of Mucous Surfaces.**

No. of Experiment.	No. of Animal.	Date.	Nature of Experiment.	RESULT.	Remarks.
221	2941	27.8.13	Nostrils swabbed with exudate and scrapings of lymphatic gland of a Cattle Plague animal.	**Positive.**	Rise of temperature after 3½×24 hours.
226	3001	10.9.13	Vagina swabbed with scrapings of the prescapular gland of a sixth day Cattle Plague animal.	**Positive.**	Rise of temperature after 4½×24 hours.

In the first experiment an animal had its nose smeared with an emulsion from a lymphatic gland of a Cattle Plague animal killed on the sixth day of the disease. Cattle Plague resulted, the initial rise of temperature occurring after three and a half days. Another animal, the vagina of which was swabbed with an emulsion of the prescapular gland of a sixth day Cattle Plague animal, developed the disease; the first rise of temperature taking place after four and a half days.

SECRETIONS AND EXCRETIONS.

All observers agree that the secretions and excretions of an animal in the acute stage of Cattle Plague are infective, but the data available as to the relative degree of infectivity of these various fluids are somewhat scanty.

Nasal secretion.

Experiments carried out in Egypt at all seasons of the year and over a period of some nine years have shown quite definitely that the nasal secretion of animals in the acute stage of Cattle Plague is invariably virulent; in fact this method has often been employed in carrying on the strain of Cattle Plague for the production of virulent blood at the Serum Institute in Cairo, where the presence of piroplasmata of Texas fever, etc., in the blood often gives rise to trouble. By infecting directly from nose to nose, Cattle Plague could be carried on without the risk of transmitting the accompanying piroplasmata.

The striking point about the nasal secretion is its very high degree of infectivity by simple contact with the mucous membranes, as shown in the following table :—

TABLE No. 21.—**Experiments to determine the Infectivity of the Fresh Nasal Discharge of Cattle Plague Animals when applied to Mucous Surfaces.**

No. of Experiment.	No. of Animal.	DATE.	NATURE OF EXPERIMENT.	RESULT.	REMARKS.
5	2	28.5.12	Nostrils swabbed with fresh nasal mucus, taken from a Cattle Plague animal, on the fourth day after its inoculation with virulent blood.	**Negative.**	Contracted the disease later, through contact with sick animals.
19	23	17.6.12	Nostrils swabbed with fresh nasal mucus from a sixth day Cattle Plague animal.	**Positive.**	Rise of temperature after 2½×24 hours.
28	1896	16.7.12	Nostrils swabbed with fresh nasal mucus from a sixth day Cattle Plague animal.	**Positive.**	Rise of temperature after 3×24 hours.
33[a]	179 (Egyptian).	7.7.12	Nostrils swabbed with fresh nasal mucus from a sixth day Cattle Plague animal.	**Negative.**	Afterwards tested with virulent blood and found to be immune.
35	1905	16.7.12	Nostrils swabbed with fresh nasal mucus from a sixth day Cattle Plague animal.	**Positive.**	Rise of temperature after 4½×24 hours.
A	1799	9.4.12	Nostrils swabbed with fresh nasal mucus from a sixth day Cattle Plague animal.	**Positive.**	Rise of temperature after 4×24 hours.
B	1808	18.4.12	Nostrils swabbed with fresh nasal mucus from a sixth day Cattle Plague animal.	**Positive.**	Rise of temperature after 3×24 hours.
C	1826	14.5.12	Nostrils swabbed with fresh nasal mucus from a sixth day Cattle Plague animal.	**Positive.**	Rise of temperature after 3×24 hours.
113	2266	27.1.13	Nostrils swabbed with fresh nasal mucus from a sixth day Cattle Plague animal.	**Positive.**	Rise of temperature after 4½×24 hours.
113	2267	27.1.13	Nostrils swabbed with fresh nasal mucus from a ninth day Cattle Plague animal.	**Positive.**	Rise of temperature after 4×24 hours.
113	2268	27.1.13	Nostrils swabbed with fresh nasal mucus from a sixth day Cattle Plague animal.	**Positive.**	Rise of temperature after 6×24 hours.
113	2269	27.1.13	Nostrils swabbed with fresh nasal mucus from a ninth day Cattle Plague animal.	**Positive.**	Rise of temperature after 4×24 hours.
113	2270	4.2.13	Nostrils swabbed with fresh nasal mucus from an eighth day Cattle Plague animal.	**Negative.**	Afterwards tested with virulent blood and found to be immune.
113	2271	4.2.13	Nostrils swabbed with fresh nasal mucus from an eighth day Cattle Plague animal.	**Positive.**	Rise of temperature after 3½×24 hours.
113	2274	4 2.13	Nostrils swabbed with fresh nasal mucus from an eighth day Cattle Plague animal.	**Positive.**	Rise of temperature after 3½×24 hours.
113	2275	4.2.13	Nostrils swabbed with fresh nasal mucus from an eighth day Cattle Plague animal.	**Positive.**	Rise of temperature after 3½×24 hours.

TABLE No. 21 (*continued*).

No. of Experiment.	No. of Animal.	DATE.	NATURE OF EXPERIMENT.	RESULT.	REMARKS.
140	2452	16.3.13	Nostrils swabbed with fresh nasal mucus from an eighth day Cattle Plague animal.	**Positive.**	Rise of temperature after 4×24 hours.
140	2476	16.3.13	Nostrils swabbed with fresh nasal mucus from an eighth day Cattle Plague animal.	**Negative.**	Nostrils swabbed a second time with nasal mucus and was positive.
140	2476	25.3.13	Nostrils swabbed with fresh nasal mucus from a sixth day Cattle Plague animal.	**Positive.**	Rise of temperature after 4×24 hours.
140	2477	16.3.13	Nostrils swabbed with fresh nasal mucus from an eighth day Cattle Plague animal.	**Positive.**	Rise of temperature after 5×24 hours.
169	2587	23.4.13	Nostrils swabbed with fresh nasal mucus from a ninth day Cattle Plague animal.	**Positive.**	Rise of temperature after 4×24 hours.
124	2969	8.9.13	Nostrils swabbed with fresh nasal mucus from a fifth day Cattle Plague animal.	**Positive.**	Rise of temperature after 4×24 hours.

With the exception of the first animal in the above table, where fourth day nasal mucus was used, of the twenty-one bulls whose nostrils were swabbed with nasal mucus, especially with a view to determining the infectivity of this secretion, eighteen developed the disease after an incubation period of from two and a half days to five and a half days. Of the remaining three, one developed the disease after the nostrils were again swabbed, and the other two on inoculation proved to be immune.

Nasal mucus kept for one or two days in a moist atmosphere is still infective.

TABLE No. 22.—**Additional Experiments on the Infectivity of Nasal Mucus.**

No. of Experiment.	No. of Animal.	DATE.	NATURE OF EXPERIMENT.	RESULT.	REMARKS.
172	2596	24.4.13	Nostrils swabbed with nasal mucus from a ninth day Cattle Plague animal; the same material as was used in Exp. No. 169, but the mucus was collected on filter paper and kept in a moist chamber in the ice-safe for 24 hours.	**Positive.**	Rise of temperature after 4½×24 hours.
173	2592	25.4.13	Nostrils swabbed with nasal mucus taken from same bull as in former experiment, but kept in the ice-safe for 48 hours.	**Negative.**	Afterwards tested with virulent blood and found to be susceptible.
176	2612	1.5.13	Nostrils swabbed with nasal mucus from a fifth day Cattle Plague animal, the nasal mucus had been kept in the ice-safe for 48 hours.	**Positive.**	Rise of temperature after 3½×24 hours.

As a matter of fact the question of the infectivity of the nasal secretions leaves no possible doubt, and the method of " nose-to-nose " infection has been used for years in the routine work of the Serum Institute. As the animals, however, after having their nostrils swabbed, had been placed in infected stables, this might have been regarded as a possible source of infection, and it was to eliminate any such possibility that the above experiment was made.

It will thus be seen that the experience in Egypt is somewhat at variance with the results recorded by Koch, but it is highly probable that this is explained by the fact that in Koch's experiments the swabbing was not made directly from nose to nose; the virus had to be carried some distance, so that the possibilities of putrefaction, drying, etc., have to be reckoned with.

The nasal mucus is naturally highly infective when given subcutaneously, as shown in the following experiments :—

TABLE No. 23.—**Experiments to determine the Infectivity of the Nasal Discharge of Cattle Plague Animals when Inoculated Subcutaneously.**

No. of Experiment.	No. of Animal.	DATE.	NATURE OF EXPERIMENT.	RESULT.	REMARKS.
36	1906	16.7.12	Emulsion of fresh nasal mucus made in salt solution: 15 c.c. of this was inoculated subcutaneously.	**Positive.**	Rise of temperature after 2½×24 hours.
36	1907	16.7.12	Emulsion of fresh nasal mucus made in salt solution: 15 c.c. of this was inoculated subcutaneously.	**Positive.**	Rise of temperature after 3×24 hours. Had an irregular temperature for five days and clinically showed signs of Cattle Plague. Recovered and was afterwards tested and found to be immune.

It also readily infects both by the vaginal mucous membrane and by the conjunctivæ.

TABLE No. 24.—**Experiments to determine the Infectivity of the Nasal Discharge of Cattle Plague Animals when applied to Mucous Surfaces.**

No. of Experiment.	No. of Animal.	DATE.	NATURE OF EXPERIMENT.	RESULT.	REMARKS.
206	2819	6.7.13	Vagina swabbed with fresh nasal mucus from a sixth day Cattle Plague animal.	**Positive.**	Rise of temperature after 4×24 hours.
222	2992	7.9.13	Vagina swabbed with fresh nasal mucus from a fourth day Cattle Plague animal.	**Positive.**	Rise of temperature after 3½×24 hours.
40	1930	27.7.12	Eyes smeared with fresh nasal mucus from an eighth day Cattle Plague animal.	**Positive.**	Rise of temperature after 5½×24 hours.

In view of the fact that nasal mucus infects so readily by the above channels, it was thought interesting to see if infection could be produced directly through the skin—a small area of the skin on the neck of a susceptible bull was shaved, lightly scarified with glass-paper and then smeared with virulent nasal mucus. The result was negative.

Urine.

Although all observers appear to agree that the urine is infective, very few data are to be found in the literature as to the degree of infectivity, though Nicolle states that 5 c.c. of Cattle Plague urine gave a fatal attack when inoculated in two cases.

It would seem that the virus of Cattle Plague makes its appearance in the urine of infected animals about the same time as the appearance of the virus in the blood, or at any rate very shortly after. The concentration of the virus is, however, probably markedly less in the urine than in the blood.

The urine of an animal was examined four days after he had been experimentally inoculated with virulent blood. 4 c.c. of his urine inoculated into a susceptible animal gave the typical disease; the first temperature rise occurring on the fourth morning. Of two bulls, each inoculated with 1/10th c.c. of the urine of different animals on the fifth day of the disease, one developed Cattle Plague while the other showed no symptoms, though he was subsequently shown to be susceptible.

TABLE No. 25.—**Experiments with the Urine of Cattle Plague Animals.**

No. of Experiment.	No. of Animal.	DATE.	NATURE OF EXPERIMENT.	RESULT.	REMARKS.
K	1668	10.10.11	Inoculated subcutaneously with 4 c.c. urine from a bull 4 days after inoculation with virulent blood.	**Positive.**	Rise of temperature after 3×24 hours.
L	1672	17.10.11	Inoculated subcutaneously with 0·1 c.c. urine from a bull 4 days after inoculation with virulent blood.	**Positive.**	Rise of temperature after 4½×24 hours.
M	1680	28.10.11	Inoculated subcutaneously with 0·1 c.c. urine from a bull 4 days after inoculation with virulent blood.	**Negative.**	Afterwards tested with virulent blood and found to be susceptible.

In connection with the infectivity of the urine the following additional experiments were made:—

TABLE No. 26.—**Experiments with the Urine of Cattle Plague Animals.**

No. of Experiment.	No. of Animal.	DATE.	NATURE OF EXPERIMENT.	RESULT.	REMARKS.
145	2509	2.53.13	Inoculated subcutaneously with 2 c.c. of the sediment of centrifugalized Cattle Plague urine.	**Positive.**	Rise of temperature after 4×24 hours.
146	2510	25.3.13	Nostrils swabbed with the sediment of centrifugalized Cattle Plague urine.	**Positive.**	Rise of temperature after 4½×24 hours.

These experiments show that the deposit from centrifugalized Cattle Plague urine produces the disease, not only when injected subcutaneously, but also by contact with the nasal mucous membrane in susceptible animals.

Peritoneal washings.

In connection with the preparation of Cattle Plague serum, Nicolle and Adil Bey elaborated a method to obtain the Cattle Plague virus in a medium free from blood. This was done by injecting into the peritoneal cavity of an animal suffering from Cattle Plague some six litres of a mixture consisting of three parts of normal saline solution and one part of a faintly alkaline solution of Martin's peptone. After at least three hours the animal was bled to death and the peritoneal fluid collected in cylinders, allowed to clot, and the clot removed.

The fluid so obtained is virulent and may kill at a dose of 1/4th c.c., but is generally less active than aqueous humour or cerebro-spinal fluid.

This method was afterwards employed by Ruediger, who was of the opinion that the peritoneal washings were more active than virulent blood and found that animals immunized with this fluid gave a much stronger serum than animals immunized with virulent blood.

Dung.

Dung, containing as it does the highly virulent discharges from the mucous membrane of the gut, is naturally infective, and most writers appear to attach considerable importance to this in connection with the infectivity of stables and manure.

This point will be discussed below in the consideration of the method of transmission of the disease and the duration of the virus outside the body.

Aqueous humour, cerebro-spinal fluid and bile.

It is interesting to note that according to Nicolle both the aqueous humour and the cerebro-spinal fluid of Cattle Plague animals are always virulent. He found that the former always produced the disease when injected in a dose of 1 c.c., but that 1/2 c.c. was not always sufficient to produce infection.

As was shown by Koch, subcutaneous inoculation with the bile of Cattle Plague animals does not produce the disease.

2.—METHODS OF THE TRANSMISSION OF THE DISEASE.

As regards the length of time for which the virus of Cattle Plague can remain alive outside the animal body very discordant statements are found in the literature.

It had been generally held by the earlier writers that the infection of Cattle Plague could persist in stables, on hay, manure, etc., for several months.

Freidberger and Fröhner state that stables may remain infectious for four and hay for five months.

Nocard quotes Müller, Heubner, and Dieckerhoff as having shown that hay, which had been kept above infected stables, has carried the disease after two and four months.

On the other hand, Koch in 1897, working under strict experimental conditions, showed that the virus is very rapidly destroyed by desiccation. The same conclusion was arrived at by Nicolle and Adil Bey in Turkey.

As the virus is also somewhat rapidly destroyed by putrefaction, it would appear improbable that it should persist for any length of time outside the animal body, except in situations where the temperature remains below the freezing point.

In view of the uncertainty attaching to this point and its important bearing on the transmission of the disease a certain number of experiments on the rôle played by air, water, etc., were carried out.

Air.

On reading through the somewhat extensive literature dealing with Cattle Plague and with the spread of the disease, it is interesting to notice the striking unanimity of opinion of observers in different parts of the world as regards the small rôle played by air-borne infection.

In this connection Friedberger and Fröhner state: "It is characteristic of the contagion of rinderpest that it can be carried only for a short distance by the air, and that this distance varies inversely with the dryness of the atmosphere, and is consequently shortest in summer. The average distance is probably twenty-five paces. It has often happened that in summer the transmission of the infection has been prevented by a ditch which separated the infected animals from the healthy. It thus appears that the contagion is rapidly destroyed in air, and especially in dry air."

According to Nencki and others, "cattle suffering from rinderpest and healthy animals may be sheltered together in an open enclosure, isolated only by a boarded partition, higher than their heads, without any infection taking place."

In order to test the possibility of conveyance of the infection by means of the air, a special stable was constructed in the boundary fence of the Serum Institute and was divided into two, so that one half of the stable communicated with the inside of the compound and the other with the outside. The partition dividing the stable into two consisted of two layers of coarse wire-netting one metre apart.

The above arrangement was made in order to minimize as far as possible any communication between the attendants on the animals in the two sides of the stable.

A susceptible Cyprus bull was kept in the outer half of the stable, while the inner half was occupied by infected cattle, in both cases the animals being tethered as close to the partition as possible.

As the Serum Institute is on the top of a hill, the stable was freely exposed to the prevailing northerly wind, the direction of which was from the infected to the non-infected side.

In the first experiment a susceptible animal was placed in the clean side of the stable. Five days later an infected Cyprus bull (second day of the fever) was put in the infected side, and remained there for six days, when he died of the disease. Two days later the animal on the clean side of the stable showed a temperature and was found to have Cattle Plague.

In this experiment it was discovered that on one occasion, in spite of all the precautions taken, an attendant from one of the most highly infected stables had been allowed to take the temperature of the experimental animal. This took place three days before the first rise of temperature. In view of the possibility of accidental infection no conclusion could be drawn from this experiment.

After the stable had been thoroughly disinfected the experiment was repeated. A susceptible animal was placed in the clean side and for eleven days the infected side was occupied by animals suffering from Cattle Plague. At the end of this time, the susceptible animal had a rise of temperature, and as it was thought that he had contracted Cattle Plague, he was transferred to the Serum Institute stable for infected animals. The course of the fever and an examination of the blood showed that the temperature was due to Egyptian fever. In order to test his susceptibility he was, however, allowed to remain in contact with infected animals and later developed Cattle Plague.

In a third experiment a susceptible animal was placed in the clean side of the stable and an animal sick of Cattle Plague in the infected side, where he remained for twenty-four hours. Several days later—the susceptible animal showing no signs of infection—an animal in the late stage of Cattle Plague was placed in the infected side, where he remained until he died three days later. Again no infection resulted. A third Cattle Plague animal was now placed in the infected side for three days. As the susceptible animal still remained well eight days after the removal of the last Cattle Plague animal, he was tested with virulent blood and developed a typical attack of the disease.

As pointed out above, no conclusions can be drawn from the first experiment, but the other experiments in which animals suffering from the acute disease were repeatedly allowed to remain in close proximity with highly susceptible animals without infection resulting definitely show that aerial infection plays no important rôle in the transmission of the disease.

Indeed, considering the fact that the clean and infected animals were tethered with their heads not more than two metres apart and separated only by two layers of coarse wire-netting, it is very striking that infection did not result, as the animals naturally showed a certain amount of interest in each other and a transference of the disease by spray infection from the nostrils would have appeared highly probable, especially as the infected animal was always on the windward side of the other.

Water.

It has generally been assumed that the transmission of the disease from animal to animal may take place by the drinking of contaminated water. Very few facts as to the action of water on the virus seem to be available, but Koch found that diluting virulent blood with twenty times its volume of distilled water did not interfere with its power of producing the disease on subcutaneous inoculation.

Nencki states that virulent blood mixed with distilled water is inactive after four to five days.

In order to investigate this question a susceptible animal was given a bucketful of artificially infected water to drink. The water was infected with the nasal discharge of four animals sick of Cattle Plague, the nostrils of these animals being swabbed with cotton wool plugs which were then rinsed in the water. Eleven days later, as the animal remained well, he was again watered with a bucket of infected water. The water was taken from the tubs at which the infected Cattle Plague animals of the Serum Institute drank and its infectivity was reinforced as before by the addition of nasal discharge from several sick animals. Six days after the second dose of infected water the animal had a rise of temperature and developed Cattle Plague.

Considering the very highly infective nature of the nasal discharge from Cattle Plague animals, and the considerable dose of the infected material used in infecting the water in the above experiment, it was somewhat surprising that infection did not take place from the first bucketful, and it was thought advisable to repeat the experiment on several animals and under more natural conditions.

At the Serum Institute, where animals were being daily inoculated with Cattle Plague for the production of virulent blood, there was no lack of infective material, and the special tubs at which these infected animals watered were used for the experiment.

In order to increase the chance of infection, a special tub was reserved for animals suffering from fever, five and six days after inoculation, *i.e.* at a time when the nasal discharge is known to be highly infective.

Two animals were isolated in a special stable and were taken to water daily at the above tub directly after the infected animals had been watered. At the expiration of six weeks, as the animals remained well, they were tested with virulent blood and found to be susceptible.

In a further experiment made under similar conditions to the last, two animals were watered at the infected tub for over three weeks, and, although susceptible, did not contract the disease.

When we consider that in the last two experiments the susceptible animals were watered twice a day for several weeks at a tub where, less than half an hour before, an infected animal had drunk, and did not contract the disease, it is difficult to imagine that under natural conditions drinking water can play any important part in the spread of the infection.

Stables.

In order to test the infectivity of stables which have been occupied by infected animals, a series of tests was made on different types of stables after the expiration of various periods from the time of their occupation by sick animals. As it was desired to simulate as closely as possible the natural conditions occurring in the country, in some cases the infected animals were allowed to die in the stable, and after the removal of the carcase everything in the stable (fodder in mangers, bedding, etc.) was left untouched. These experiments were made both in dry matting stables, freely exposed to the wind and sun, and in closed brick stables with concrete floors. The results will be seen in the following table :—

TABLE No. 27.—**Experiments to determine the Infectivity of Stables.**

No. of Experiment.	No. of Animal.	DATE.	NATURE OF EXPERIMENT.	RESULT.	REMARKS.
44	1934	5.8.12	August 1, infected animals removed from Cyprus infected stable. Stable remained empty for 4 days. August 5, Cyprus No. 1934 put in stable. August 7, Cyprus No. 1934 transferred to Commission stables.	**Positive.**	Rise of temperature after 3½×24 hours after isolation.
50	1940	11.8.12	August 1, infected animals removed from Cyprus infected stable. Stable remained empty for 4 days. August 11, Cyprus No. 1940 put in stable. August 14, Cyprus No. 1940 transferred to Commission stables.	**Doubtful.**	Rise of temperature after 8½×24 hours after isolation.
130	2481	5.3.13	Put into an infected stable 10 days after removal of sick bull which died in the stable.	**Negative.**	Afterwards tested with virulent blood and found to be susceptible.
139	2471	12.3.13	Put into an infected stable emptied 24 hours previously. This stable was infected with Cyprus No. 2450 which had a Cattle Plague rise of temperature and remained in the stable for 30 hours.	**Negative.**	Afterwards tested with virulent blood and found to be susceptible.
141	2486	19.3.13	Put into a stable immediately after the removal of a sick bull, the latter having remained in the stable for 48 hours after first rise of temperature.	**Negative.**	Afterwards tested with virulent blood and found to be susceptible.
163	2570	20.4.13	Put into an infected loose-box 9 days after the removal of an animal which had been allowed to die of Cattle Plague in the box—the forage, manure, etc., of the sick animal being allowed to remain.	**Negative.**	Afterwards tested with virulent blood and found to be susceptible.
192	2667 and 2668	22.5.13	Put into an infected stable closed for 7 days after the removal of an animal which had been allowed to die of Cattle Plague in the stable—the forage, manure, etc., of the sick animal being allowed to remain.	**Negative.**	Afterwards tested with virulent blood and found to be susceptible.

From the above it will be seen that the experiments were all negative, with the exception of two. In these two the conditions were somewhat exceptional, as the stable employed was that in which the infected Cyprus animals for the routine supply of virulent blood to the Serum Institute had been kept. Before the stable was vacated for the purpose of this experiment, it had for months contained on an average twelve bulls in different stages of the disease, from the day of inoculation with virulent blood up to the fourth day of fever, when they were bled to death for virulent blood, so that the concentration of the infection was probably much greater than would be likely to occur in an ordinary stable under natural conditions. In the remaining six experiments, infection did not occur, in spite of the fact that the animals fed on the food left in the manger and that the stable still contained the bedding, dung, etc., of the infected animal.

Forage and manure.

The results of these experiments were in themselves sufficient to indicate that infected forage and dung, unless quite fresh, cannot seriously be regarded as important factors in the spread of the disease, and further experiments tended to confirm this view. In one case a susceptible animal was fed on three occasions with chopped straw taken directly from the mangers of infected cattle. Infection did not result and he was then fed continuously with similar infected material for six days, again with negative results. Another animal was on two occasions fed with chopped straw mixed with the dung of Cattle Plague animals, the dung having previously been allowed to dry in the shade for twenty-four hours. In this case again infection did not result.

Blood.

As has been pointed out above in dealing with the localisation and properties of the virus, one of the most striking results so far obtained, and one which has an important bearing on any regulations framed for dealing with the disease, is the fact that the blood of sick animals, though highly virulent when injected subcutaneously, appears to be incapable of transmitting the disease by the ordinary methods of infection, at any rate in small doses. This being the case, blood-stained hands, clothing, etc., under ordinary conditions play no part in the spread of the disease. It is true that Cattle Plague blood in certain doses can produce the disease when swallowed, but this event under ordinary conditions must be regarded as somewhat improbable. The same applies to the probability of infection by means of the conjunctivæ.

Meat.

It has been shown that as regards its infectivity, the juice of Cattle Plague meat appears to behave in the same way as virulent blood, and does not infect by means of the mucous membranes, so that it is obvious that for practical purposes Cattle Plague meat may be disregarded as a means of spreading the disease. This refers only to the meat proper and not to the viscera, for it has been found that scrapings from the mucous membrane lining the stomach and emulsions of the liver, spleen, etc., readily transmit the disease by the ordinary methods of contact.

Hides.

In most epidemics of Cattle Plague the transport of the hides of diseased animals has been suspected of playing an important part in the spread of the disease. This was particularly the case in Egypt, where, in spite of the prohibition of such transport, it was known that a very large amount of illicit dealing in hides took place. In view of the importance of the skin trade in the country it was necessary to have precise information as to whether the transport of hides could actually spread the disease and, if so, how this difficulty could be best met without unduly interfering with the trade. A considerable number of experiments were accordingly undertaken.

The method of carrying out these experiments was as follows:—

The hide was spread on the floor of the stable and a susceptible Cyprus bull was so tethered that he came intimately into contact with the hide, sleeping on it and eating his food off it.

The hides were tested when quite freshly removed from the animal, and also after keeping for different periods under various conditions.

When not otherwise stated, these experiments were made with the hides of animals which had been bled to death on the seventh day after inoculation with virulent blood; but in some cases the animals from which the hides were taken were allowed to die in order to simulate more closely the natural conditions; these cases are specially noted.

TABLE No. 28.—**Experiments to determine the Infectivity of the Hides of Cattle Plague Animals.**

No. of Experiment.	No. of Animal.	DATE.	NATURE OF EXPERIMENT.	RESULT.	REMARKS.
21	24	17. 6.12	Fed off a fresh Cattle Plague hide.	**Negative.**	Afterwards tested and found to be susceptible.
34	1903	14. 7.12	Fed off the hide of an animal dead of Cattle Plague.	**Positive.**	Rise of temperature after 4×24 hours.
38	1926	24. 7.12	Fed off the hide of an animal dead of Cattle Plague.	**Negative.**	Afterwards tested and found to be susceptible.
75	2034	21. 9.12	Fed off the hide of an animal dead of Cattle Plague.	**Positive.**	Rise of temperature after 5×24 hours.
20	22	17. 6.12	Fed off a hide which had been sprinkled with salt immediately after removal.	**Negative.**	Afterwards tested and found to be susceptible.
134	2468	8. 3.13	Fed off the hide of an animal dead of Cattle Plague.	**Negative.**	Afterwards tested and found to be susceptible.
126	2435	2. 3.13	Fed off the outer side of a hide which had been smeared with Cattle Plague manure immediately after removal.	**Negative.**	Afterwards tested and found to be susceptible.
119	2311	8. 2.13	Fed off the hide of a Cattle Plague animal which was bled to death on the eighth morning after inoculation with virulent blood.	**Negative.**	Afterwards tested and found to be susceptible.
105	2301	26.12.12	Fed off the hide of a Cattle Plague animal which was bled to death on the ninth morning after inoculation with virulent blood.	**Negative.**	Afterwards tested and found to be susceptible.
13	1838	6.6.12	Fed off a Cattle Plague hide which had been folded and kept in the shade for 9½ hours.	**Negative.**	Afterwards tested and found to be susceptible.

TABLE NO. 28 (*continued*).

No. of Experiment.	No. of Animal.	DATE.	NATURE OF EXPERIMENT.	RESULT.	REMARKS.
14	$1839\frac{2}{2}$	6.6.12	Fed off a Cattle Plague hide which had been dried in the shade on a wooden frame for 9½ hours.	**Negative.**	Afterwards tested and found to be susceptible.
12	9	6.6.12	Fed off a Cattle Plague hide which had been salted, folded and kept in the shade for 9½ hours.	**Negative.**	Afterwards tested and found to be susceptible.
8	4	28.5.12	Fed off a Cattle Plague hide which had been spread in the shade for 24 hours.	**Negative.**	Afterwards tested and found to be susceptible.
7	3	28.5.12	Fed off a Cattle Plague hide which had been salted and spread out in the shade for 24 hours.	**Negative.**	Afterwards tested and found to be susceptible.
76	2035	21.9.12	Fed off the hide of an animal dead of Cattle Plague. The hide had been folded up and kept in the shade for 24 hours.	**Doubtful.**	Rise of temperature after 12×24 hours. Possibility of accidental infection.
128	2436	3.3.13	Fed off the outer side of a Cattle Plague hide which had been smeared with manure and mucus from a bull suffering from Cattle Plague, the hide having been rolled up and kept in the shade for 24 hours.	**Doubtful.**	Animal showed a temperature reaction between 12th and 20th day after being placed in contact with hide. Afterwards tested with virulent blood and found to be immune.
160	2549	12.4.13	Fed off the hide of an animal dead of Cattle Plague, the hide having been folded up and kept in the shade for 24 hours.	**Negative.**	Afterwards tested and found to be susceptible.
3	1828	15.5.12	Fed off a Cattle Plague hide which had been rolled up wet and kept in the shade for 48 hours.	**Negative.**	Afterwards tested and found to be susceptible.
4	1829	15.5.12	Fed off a Cattle Plague hide which had been dried on the roof for 48 hours.	**Negative.**	Afterwards tested and found to be susceptible.
18	25	19.6.12	Drenched with 1 litre of water in which a hide had been soaked, the hide having previously been folded up and kept in the shade for 48 hours.	**Negative.**	Afterwards tested and found to be susceptible.

It will be seen from these experiments that only in one or two instances was it possible to infect a susceptible animal by means of a Cattle Plague hide.

As in these experiments the animals were brought into more intimate contact with the infected hides than was ever likely to occur under natural conditions, we are probably safe in assuming that the transport of hides plays no important part in the spread of the disease.

The fact that Cattle Plague hides are not virulent in virtue of the blood which they contain, but only by means of the infectious secretions with which they may be externally contaminated, has an important bearing on the practical question of their disinfection; as it is only necessary for the disinfectant to attack these secretions and there is no necessity that it should penetrate into the substance of the hide.

As the virus of Cattle Plague is somewhat rapidly destroyed by dessication, the thorough drying of the hides for forty-eight hours is probably the simplest and most effective method of dealing with the question.

Carcases.

As the virus shows very little resistance to the process of putrefaction, and as the carcases of animals which have died of Cattle Plague are not likely to be transported to any distance, carcases may be neglected as a factor in the transmission of the disease, and if properly buried at a reasonable depth rapidly lose their infective power.

Intermediaries.

As regards the question of the part played by intermediaries in the transmission of the disease—leaving out of account for the present the possibility of an intermediate insect host—this must be considered under two headings.

In the first place, there is the simple mechanical transport of the infection by flies, men, dogs, etc., from infected to non-infected animals. Considerable stress has been laid on this method of infection by many writers, who have even gone so far as to suggest that dogs which have fed on the flesh of Cattle Plague animals may disseminate the infection by means of their fæces. The fact that the nasal discharge of sick animals is so highly infectious renders it evident that the disease can be transferred from sick to healthy animals by attendants passing from one to the other, if by chance in this process some of the infected mucus has adhered to their hands or clothing and has come into contact with the nasal or other mucous membranes of a susceptible animal.

The fortuitous nature of such transmission of the infection is well shown in the following experiments, in which susceptible animals were isolated in special stables, but were fed, groomed, and watered, by an attendant who was at the same time in charge of the infected stable of the Serum Institute, where the animals inoculated with Cattle Plague for the production of virulent blood were kept.

TABLE NO. 29.—**Experiments to determine the Infectivity of Cattle Plague Attendants.**

No. of Experiment.	No. of Animal.	DATE.	NATURE OF EXPERIMENT.	RESULT.	REMARKS.
118	2404 and 2405	4.2.13	From February 4 to March 25 (50 days) isolated and attended by *Syce* of the infected Cyprus animals.	**Negative.**	Afterwards tested and found to be susceptible.
144	2501 and 2502	25.3.13	From March 25 to April 6 (13 days) isolated and attended by *Syce* of the infected Cyprus animals.	**Negative.**	Afterwards tested and found to be susceptible.
158	2538	9.4.13	From April 9-29 (20 days) isolated and attended by *Syce* of the infected Cyprus animals.	**Positive.**	Rise of temperature after 15½×24 hours.
158	2539	9.4.13	From April 9-29 (20 days) isolated and attended by *Syce* of the infected Cyprus animals.	**Positive.**	Rise of temperature after 15½×24 hours.

It will be seen that only two out of six animals in the above tests contracted the disease, and in one experiment two susceptible animals were in the charge of the attendant for a period of fifty days without becoming infected.

In view of the ease with which the virus is destroyed by desiccation, etc., however, it appears improbable that the infection should be transported for any considerable distance in this manner, and undue importance has probably been attached to the conveyance of the infection by clothing and similar objects.

The presence of the causal organism in large numbers in the blood of animals suffering from the disease naturally suggests the possibility of its transmission by bloodsucking insects. We have, however, as yet no evidence that such transmission takes place.

In addition to the simple mechanical transference of the infection, it has been suggested that animals other than cattle, which are susceptible to the disease, may contract Cattle Plague, possibly in a mild form, and that such animals, though showing no obvious symptoms may still be infective and, in fact, act as " carriers " of the infection. Attention has been directed in different countries to the sheep, goat, and buffalo.

In South Africa the disease was undoubtedly spread over large areas by means of big game, but these animals actually suffered from the acute disease and could not be regarded as " carriers " in the ordinary sense of the term.

Goats.

The susceptibility of sheep and goats to Cattle Plague varies very widely in different races and in different parts of the world. Nicolle and Adil Bey, working in Turkey with Anatolian and Maltese goats, found that the goat is certainly susceptible to Cattle Plague, and in most cases dies of the disease—death taking place in from nine to sixty days, the blood of the infected goats causing the disease when inoculated into susceptible cattle.

Koch, in the Cape, found that goats inoculated with Cattle Plague blood showed no marked symptoms, but all suffered, after a period of incubation extending over two or three days, from a rise of temperature identical with that of Rinderpest.

Memo, Martoglio, and Adani, in Erythrea, state that the Abyssinian goat is highly susceptible, and they found that one of these animals, inoculated with 1 c.c. of virulent blood, showed a typical Cattle Plague temperature, with death on the twelfth day. This animal had a discharge from the nose with typical mouth lesions, and his blood transmitted the typical disease on inoculation into a bull.

Leonard Rogers, working at Muktesar, in India, was able to infect goats, both by placing them in contact with sick cattle and also by the injection of virulent blood. The type of the disease was very variable in different individuals. He refers to an outbreak of Cattle Plague in the Himalayas which was introduced into two villages by infected goats with most deplorable results.

In order to determine the susceptibility of the Egyptian goat a number of these animals were inoculated subcutaneously with virulent Cattle Plague blood as follows :—

TABLE No. 30.—**Experiments to determine the Susceptibility of Goats.**

No. of Experiment.	No. of Animal.	DATE.	NATURE OF EXPERIMENT.	RESULT.	REMARKS.
67	1	7. 9.12	Inoculated subcutaneously with 1 c.c. virulent blood.	**Negative.**	No reaction.
67	2	7. 9.12	Inoculated subcutaneously with 1 c.c. virulent blood.	**Positive.**	Rise of temperature after 2½×24 hours.
67	3	7. 9.12	Inoculated subcutaneously with 10 c.c. virulent blood.	**Positive.**	Rise of temperature after 3×24 hours.
67	4	7. 9.12	Inoculated subcutaneously with 10 c.c. virulent blood.	**Positive.**	Rise of temperature after 2½×24 hours.
67	5	7. 9.12	Inoculated subcutaneously with 50 c.c. virulent blood.	**Positive.**	Rise of temperature after 2½×24 hours.
67	6	7. 9 12	Inoculated subcutaneously with 50 c.c. virulent blood.	**Positive.**	Rise of temperature after 3½×24 hours.
81	7	7.10.12	Inoculated subcutaneously with 5 c.c. virulent blood.	**Indefinite.**	Slight rise of temperature but no definite reaction.
81	8	7.10.12	Inoculated subcutaneously with 5 c.c. virulent blood.	**Positive.**	Slight rise of temperature.
81	9	7.10.12	Inoculated subcutaneously with 5 c.c. virulent blood.	**Positive.**	Slight rise of temperature.
81	10	7.10.12	Inoculated subcutaneously with 5 c.c. virulent blood.	**Indefinite.**	Slight rise of temperature but no definite reaction.
81	11	7.10.12	Inoculated subcutaneously with 5 c.c. virulent blood.	**Positive.**	Slight rise of temperature.
81	12	7.10.12	Inoculated subcutaneously with 5 c.c. virulent blood.	**Negative.**	No reaction.
81	13	7.10.12	Inoculated subcutaneously with 5 c.c. virulent blood.	**Positive.**	Slight rise of temperature.
81	14	7.10.12	Inoculated subcutaneously with 5 c.c. virulent blood.	**Indefinite.**	No definite reaction.
81	15	7.10.12	Inoculated subcutaneously with 5 c.c. virulent blood.	**Indefinite.**	No definite reaction.
81	16	7.10.12	Inoculated subcutaneously with 5 c.c. virulent blood.	**Indefinite.**	No definite reaction.
81	17	7.10.12	Inoculated subcutaneously with 5 c.c. virulent blood.	**Indefinite.**	No definite reaction.
82	19	7.10.12	Inoculated subcutaneously with 5 c.c. virulent blood.	**Negative.**	No reaction.
82	20	7.10.12	Inoculated subcutaneously with 5 c.c. virulent blood.	**Negative.**	No reaction.
82	21	7.10.12	Inoculated subcutaneously with 5 c.c. virulent blood.	**Negative.**	No reaction.
82	22	7.10.12	Inoculated subcutaneously with 5 c.c. virulent blood.	**Negative.**	No reaction.

Of the above animals, five (Nos. 2–6) were Bedouin goats, while the remaining sixteen were Egyptian, either pure or crossed with Maltese.

Of the sixteen Egyptian animals inoculated, only five showed definite reactions, and even these reactions were not very pronounced. The Bedouin goats, on the other hand, all showed severe and somewhat prolonged temperature reactions, although all the animals recovered. The clinical signs were not as a rule marked, but in one case, diarrhœa, and in several, nasal discharge was observed.

Blood taken from one of the above Bedouin goats, seven days after inoculation with virulent blood, produced Cattle Plague in a Cyprus bull. On the other hand, a susceptible bull, placed with these five Bedouin goats on the seventh day after they were inoculated with virulent blood and allowed to remain in intimate contact with them for some days, did not contract the disease. As the animals were placed together in a loose-box, there was every opportunity for infection.

Sheep.

As regards the susceptibility of sheep to the disease, Lingard, in India, found that plains' sheep rarely succumb to Rinderpest, but that Tibetan sheep brought over the Himalayas to the laboratory died of the disease.

Nicolle and Adil Bey, working with Asiatic and with fat-tailed sheep, found that even enormous doses of virulent blood gave only a rise of temperature with no general symptoms, although the blood of the sheep taken on the fifth day was infectious for cattle at a dose of 5 c.c.

Koch, in Cape Colony, found that Cape sheep, Merino sheep and Angoras, when inoculated with virulent blood, behaved in the same manner as goats. He passed the virus five times through sheep and then into cattle and thought that this considerably increased the virulence. It is interesting to notice that Kolle and Turner were unable to infect cattle by swabbing their nostrils with the nasal mucus of sheep which had been inoculated with virulent blood.

Memmo, Martoglio and Adani found that the Abyssinian sheep is susceptible to Cattle Plague, and that the disease in these animals has a somewhat lengthy and irregular course—death taking place in from thirteen to thirty-six days. The symptoms are so scanty that the natives deny that sheep may be infected; the animals may waste and show a more or less abundant nasal discharge and almost invariably have diarrhœa. Healthy sheep placed in contact with the sick are constantly infected, showing a rise of temperature on the fifth day. Passage from sheep to sheep has been carried out for six passages. The blood of infected sheep caused the typical disease when inoculated into cattle.

Rogers, in India, was able to produce infection in sheep by the inoculation of virulent blood, and in one case infected a lamb by contact with cattle suffering from the disease. He refers to the Tibetan sheep as a possible transporter of the natural infection in the Himalayas.

In some countries (*e.g.* Cape Colony, India, etc.), where for the purpose of simultaneous inoculation it has been necessary to transport virulent blood over long distances, advantage has been taken of the fact that the virus of Cattle Plague multiplies in the body of the sheep, and sheep inoculated with the disease have been sent to the districts where virulent blood was required.

Experiments on the susceptibility of Egyptian sheep are at present in progress. These are not yet completed, but so far the experiments show that, when inoculated with virulent blood, these animals present no clinical symptoms beyond, perhaps, a slight rise of temperature, although their blood taken a week after the inoculation produces the disease when inoculated into susceptible cattle.

Buffalo.

As regards the buffalo, the general experience in Egypt is that, while the buffalo may contract Cattle Plague and even die of the disease, this animal is very much less susceptible than the cattle of the country. Very often in affected villages the buffaloes apparently escape altogether, and if they are affected they commonly have a benign form of the disease, though at times acute cases occur. As it was almost impossible to obtain buffaloes known with certainty never to have been in contact with Cattle Plague, buffalo calves were used so as to minimise this risk, and a number were inoculated with virulent blood. Of nine of these animals, eight showed no reaction, but in the ninth the temperature was very irregular between the sixth and the tenth day after inoculation and blood taken on the eleventh day gave the disease to a susceptible bull.

This result agrees with that found in experiments made before the formation of the Commission. In these experiments thirteen buffalo calves were inoculated with quantities of virulent blood varying from 1/10th c.c. to 350 c.c. One animal died from Cattle Plague. Of the remaining twelve, none showed any clinical symptoms, though some had a slight rise of temperature, generally after an incubation period of from three to five days.

There is therefore no doubt that although the buffalo enjoys as a rule a considerable degree of natural immunity, susceptible individuals exist, and these can contract Cattle Plague and act as transmitters of the disease.

How large a percentage of these susceptible animals exists could only be determined by the inoculation of large numbers of buffaloes in different districts.

As regards other animals which might be considered in this connection, experiments carried out in Cairo on the pig and camel have given entirely negative results.

Direct animal to animal infection.

It will be seen from the foregoing experiments that an animal sick of Cattle Plague is infective mainly, if not exclusively, in virtue of the highly infective discharges from the nose, mouth, gut, etc. As the virus is, however, somewhat rapidly destroyed by desiccation and putrefaction, under ordinary circumstances these discharges rapidly lose their infective character. The sick animal, on the other hand, is a continual source of these infective discharges, and it is to such sick animals that attention must be directed in dealing with the disease.

Animals incubating the disease do not appear to be infective and only become so with the onset of fever and the accompanying clinical signs. If the animal recovers from the disease, the disappearance of the infectivity probably, as a general rule, coincides with the disappearance of the fever and clinical symptoms, and this is borne out in the following experiments :—

In these experiments either naturally-recovering animals were used or, when such were not available, animals were inoculated with virulent blood and the necessary dose of serum to insure their recovery. At different periods susceptible animals were placed with them.

TABLE No. 31.—Contact Experiments.

No. of Experiment.	No. of Animal.	DATE.	NATURE OF EXPERIMENT.	RESULT.	REMARKS.
129	2448	3.3.13	Placed in contact with an animal recovered from Cattle Plague (eighth day after subsidence of fever.)	Negative.	Afterwards tested with virulent blood and found to be susceptible.
147	2511	26.3.13	Placed in contact with an animal recovered from Cattle Plague (second day after subsidence of fever.)	Negative.	Afterwards tested with virulent blood and found to be susceptible.
152	2527	5.4.13	Placed in contact with two animals recovered from Cattle Plague (fourth day after subsidence of fever and eleventh day after they had been simultaneously inoculated.)	Negative.	Afterwards tested with virulent blood and found to be susceptible.
178	2614	2.5.13	Placed in contact with two animals, which had been simultaneously inoculated, immediately after subsidence of fever.	Negative.	Afterwards tested with virulent blood and found to be susceptible.

It will be noted that in no case did infection result. The date of the disappearance of the virus from the discharges therefore appears to coincide with the date of the disappearance of the virus from the blood.

In connection with the infectivity of stables, it was shown that when a susceptible animal is placed in a stable which has recently been vacated by an animal sick of the disease, infection does not as a rule take place, even although the infected manure, fodder, etc., have not been removed. If, however, the susceptible animal is placed in a stable which actually contains a sick animal, infection invariably takes place, as is shown in the following experiments:—

In these experiments susceptible Cyprus animals were placed in the infected stable in contact with animals which had been inoculated with virulent blood.

TABLE No. 32.—Contact Experiments.

No. of Experiment.	No. of Animal.	DATE.	NATURE OF EXPERIMENT.	RESULT.	REMARKS.
N	107	3.10.07	Placed in contact.	Positive.	Rise of temperature after 6×24 hours.
O	152	20.10.07	„ „	Positive.	Rise of temperature after 6×24 hours.
P	183	17.11.07	„ „	Positive.	Rise of temperature after 13×24 hours.
Q	258	30.12.07	„ „	Positive.	Rise of temperature after 12×24 hours.
R	301	19. 1.08	„ „	Positive.	Rise of temperature after 7×24 hours.
S	343	10. 2.08	„ „	Positive.	Rise of temperature after 8×24 hours.

TABLE No. 32 (*continued*).

No. of Experiment.	No. of Animal.	DATE.	NATURE OF EXPERIMENT.	RESULT.	REMARKS.
T	630	21.6.08	Placed in contact.	**Positive.**	Rise of temperature after 9×24 hours.
U	800	30.9.08	„ „	**Positive.**	Rise of temperature after 13×24 hours.
V	801	30.9.08	„ „	**Positive.**	Rise of temperature after 4×24 hours.
X	4 Roumanian.	29.1.08	„ „	**Positive.**	Rise of temperature after 10×24 hours.
Y	1819	6.5.12	„ „	**Positive.**	Rise of temperature after 5×24 hours.
64	1858	30.7.12	„ „	**Positive.**	Rise of temperature after 12×24 hours.
64	1909	30.7.12	„ „	**Positive.**	Rise of temperature after 5×24 hours.

In short, as the result of a considerable experience of the disease, the authors are driven to the conclusion that by far the most important part in the spread of the disease is played by actual "animal to animal" infection. As a general rule, the direct transference of the infection from ox to ox is probably sufficient to explain the spread of the disease, but under certain circumstances it is quite possible that other susceptible animals, such as sheep, goats, and buffaloes, may be concerned.

3.—GENERAL CONSIDERATIONS ON THE NATURE OF THE CAUSAL ORGANISM.

Koch in his now classical work on Cattle Plague, done at the Cape in 1897, showed that the blood of animals sick of Cattle Plague, though containing the causal agent of the disease, gives no growth on the ordinary culture media either under aerobic or anaerobic conditions. He was, moreover, unable by the microscope to demonstrate the presence of any micro-organism. These results have since been confirmed by other workers.

From the preceding experiments on the infectivity of Cattle Plague blood on subcutaneous inoculation, we have seen that 1/2,000th c.c. of virulent blood may be sufficient to infect a susceptible animal. This blood must therefore contain at least 2,000 of the causal organisms in a cubic centimetre, and as it is somewhat improbable that the injection of one of these causal agents is sufficient to reproduce the disease, it is probable that the blood contains considerably more than this number.

We have therefore in virulent Cattle Plague blood a fluid rich in the causal organism of the disease and at the same time free from other organisms, so that it constitutes an ideal starting point for the study of the disease.

Kolle, in 1899, considerably simplified matters by showing that when virulent blood is centrifugalized for twenty to thirty minutes in a high speed centrifuge at 2,000–3,000 revolutions a minute the supernatant fluid is quite non-infective, the virus having come down with the cells.

As referred to in discussing the relation of the virus to the blood cells, the writers were able not only to confirm this result of Kolle, but also to prove definitely by a series of fractional centrifugalizations that the virus comes down in the layer containing the white cells and that a red cell layer almost entirely free from the virus can be obtained.*

From the results of his centrifugalization experiments, together with the fact that the virus contained in the blood did not pass through either the Berkefeld or Chamberland filter, even after dissolving the corpuscles in 0·2 per cent saline, Kolle was of the opinion that the causal organism of Cattle Plague must be of such a size as to be visible if an appropriate method of staining could be found.

This conclusion is hardly justified, for if the virus is intra-cellular and is contained in the white cells, the results of these experiments would give no clue to the size of the causal agent. As the white cells would not be dissolved by 0·2 per cent saline, they would still come down on centrifugalization and would be retained by a filter.

As we have seen that on centrifugalizing blood the causal agent comes down definitely in the white cell layer, we have two possibilities, *viz.* :—

(1) That the virus is free in the plasma.

(2) That it exists in some of the cells which constitute the white cell layer.

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* Braddon (*Parasitology*, Vol. 6, No. 3, p. 265) has recently described bodies which he has found in the red-cells in cases of Rinderpest. These he has kindly demonstrated to us, but so far we are not in a position to make any definite statement as to their nature.

To consider the first of these possibilities. If the organism is extra-cellular and free in the plasma, in order that it should come down in the white cell layer on centrifugalizing, it must have a size and specific gravity comparable with that of the cells contained in this layer, or if it is smaller it must have a correspondingly higher specific gravity. If it is so small as to be ultra-microscopic, the specific gravity would exceed the limits of possibility. We may therefore safely conclude that if the organism is extra-cellular, it must have such dimensions as to be easily visible under ordinary magnifications, provided that it is capable of being stained. As the most careful microscopic examination, both of unstained specimens (under dark ground illumination, and by Burri's method, etc.) and of films stained by all the ordinary methods, reveals nothing of the nature of a parasite, we must conclude that the causal organism cannot be extra-cellular, except in the somewhat improbable event of its having exactly the same refractive index as the blood serum, and at the same time not staining by any of the ordinary methods.

The possibility of the parasite being in the red cells, and lowering their specific gravity to such an extent as to bring them into the white cell layer, need not be seriously considered.

In view of the foregoing, the probability is entirely in favour of the organism being intra-cellular, though no evidence is as yet forthcoming as to which type of cell in the white cell layer acts as its host. The intra-cellular location of the parasite would explain the fact that the virus, as it exists in the blood, does not pass through a Berkefeld or Chamberland filter, and might also account for the non-infectivity of virulent blood when applied to mucous membranes. The fact that certain materials such as nasal discharge, etc., are highly infective by simple contact with mucous membranes, suggests that in these materials the organism may be extra-cellular, and it is quite possible that this may explain the positive results obtained by several observers in filtration experiments with such materials.

The writers hope that time may be found for the continuation of the investigations along these lines, when the more important of the questions bearing on practical measures have been dealt with.

4.—LITERATURE.

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5.—METEOROLOGICAL DATA for the Period during which the Experiments were Carried Out.

(Taken at the Government Observatory, Helwân.)

Year.	Month.	Temperature Mean.	Temperature Minimum.	Temperature Maximum.	Maximum Vapour Pressure at Mean Temperature.	Actual Vapour Pressure.	Saturation Deficit.
1912	April	20·1	13·6	28·7	17·5	7·3	10·2
	May...	22·4	15·8	30·8	20·1	6·8	13·3
	June	26·2	19·4	34·4	25·2	9·6	15·6
	July	26·4	20·4	34·3	25·6	11·5	14·1
	August	26·8	20·7	34·4	26·2	12·7	13·5
	September	24·8	19·4	31·6	23·2	12·3	10·9
	October	22·9	18·2	29·5	20·7	10·9	9·8
	November	18·4	13·5	25·2	15·7	7·6	8·1
	December	13·3	9·3	19·1	11·4	7·3	4·1
1913	January	12·3	8·2	18·3	10·6	6·4	4·2
	February	12·8	8·2	19·7	10·0	5·7	5·3
	March	14·9	9·3	22·6	12.6	6·2	6·4
	April	20·6	14·2	29·0	18·0	7·0	11·0
	May...	22·4	16·7	30·1	20·1	7·8	12·3
	June	24·6	17·8	33·0	23·0	9·1	13·9
	July	26·2	19·8	34·6	25·2	10·8	14·4
	August	26·5	20·5	33·9	25·7	12·2	13·5
	September	25·9	19.6	32·8	24·8	12·2	12·6
	October	22·8	17·6	29·7	20·6	10·6	10·0
	November	17·0	12·6	23·0	14·4	8·7	5·7
	December	12·8	8·9	18·5	11·0	6·2	4·8
1914	January	12·9	8·5	19·6	11·1	5·9	5·2
	February	13·4	8·5	20·1	11·4	6·3	5·1
	March	17·5	11·9	25·2	14·9	6·4	8·5

6.—DETAILS OF EXPERIMENTS.

In the following experiments, in all cases where the temperature charts are of interest, they have been included, together with the essential details:—

TABLE No. 1.—**Experiments to determine the Infectivity of Cattle Plague Blood when applied to Nasal Mucous Membranes.**

EXPERIMENT No. 23.

On June 24, 1912, Cyprus bull No. 1840 $\frac{3}{3}$ had his nostrils swabbed with virulent blood and was isolated in the Commission stables.

No reaction.

On July 2, 1912, was tested with virulent blood.

On July 6, 1912, had a rise of temperature.

On July 8, 1912, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

On June 24, 1912, Cyprus bull No. 1841 $\frac{4}{4}$ had his nostrils swabbed with virulent blood and was isolated in the Commission stables.

No reaction.

On July 2, 1912, was tested with virulent blood.

On July 5, 1912, had a rise of temperature.

On July 8, 1912, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Negative in both cases. Neither animal contracted the disease from the blood smear, although both were afterwards found to be susceptible when tested with virulent blood.

EXPERIMENT No. 28.

On July 8, 1912, Cyprus bull No. 1896 had his nostrils swabbed with virulent blood and was isolated in the Commission stables.

No reaction.

On July 16, 1912, his nostrils were swabbed with nasal mucus from a sixth day cattle plague animal (Cyprus No. 1891).

On July 19, 1912, had a rise of temperature.

On July 23, 1912, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Negative. Did not contract the disease from the blood smear, although afterwards found to be susceptible when nostrils were smeared with nasal mucus.

EXPERIMENT No. 108.

On January 11, 1913, Cyprus bulls Nos. 2266, 2267, 2268, and 2269, had their nostrils swabbed with virulent blood and were isolated in the Commission stables.

No reaction.

On January 27, 1913, their nostrils swabbed with nasal mucus.

Reaction.—See experiment No. 113.

On January 11, 1913, Cyprus bulls Nos. 2270, 2271, 2274, and 2275, had their nostrils swabbed with virulent blood and were isolated in the Commission stables.

No reaction.

On February 4, 1913, their nostrils swabbed with nasal mucus.

Cyprus bulls Nos. 2271, 2274, and 2275, reacted.
See experiment No. 113.

Cyprus bull No. 2270 was immune.

Note.—*Cyprus bull No. 2274* was off food for two days, and had a rise of temperature on January 17, 1913 (Texas Fever).

Result.—Negative in every case. None of the animals contracted the disease from the blood smear, although afterwards, with one exception, they were all found to be susceptible when their nostrils were smeared with nasal mucus.

Experiment No. 140.

On March 16, 1913, Cyprus Nos. 2451, 2473, and 2479, had their nostrils swabbed with virulent blood and were isolated in the Commission stable No. 8.

No reaction.

On March 25, 1913, their nostrils were again and more freely swabbed with virulent blood.

Cyprus No. 2451, did not react.

On April 1, 1913, was tested with virulent blood.

On April 5, 1913, had a rise of temperature.

On April 8, 1913, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Negative. Did not contract the disease from the blood smears, although afterwards found to be susceptible when tested with virulent blood.

Cyprus Nos. 2473 and 2479.

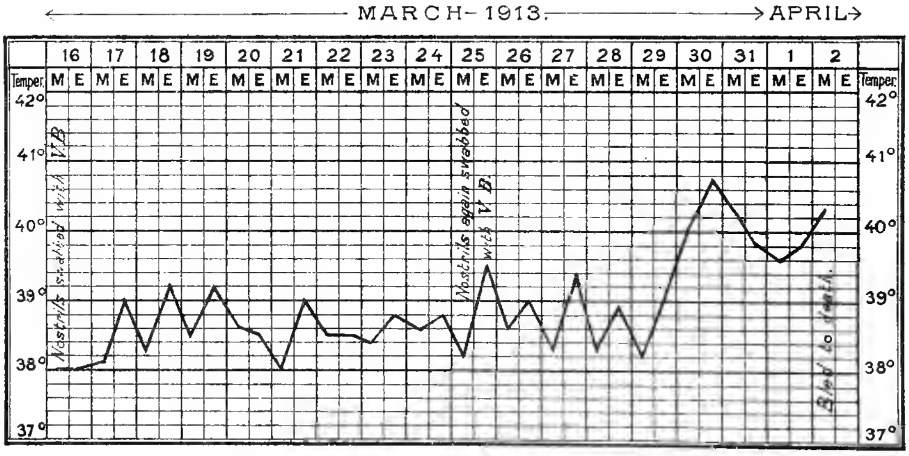
On March 30, 1913, both animals had a rise of temperature.

On April 2, 1913, they were bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease after a second—more liberal—swabbing of the nostrils.

CYPRUS No. 2473.



CYPRUS No. 2479.

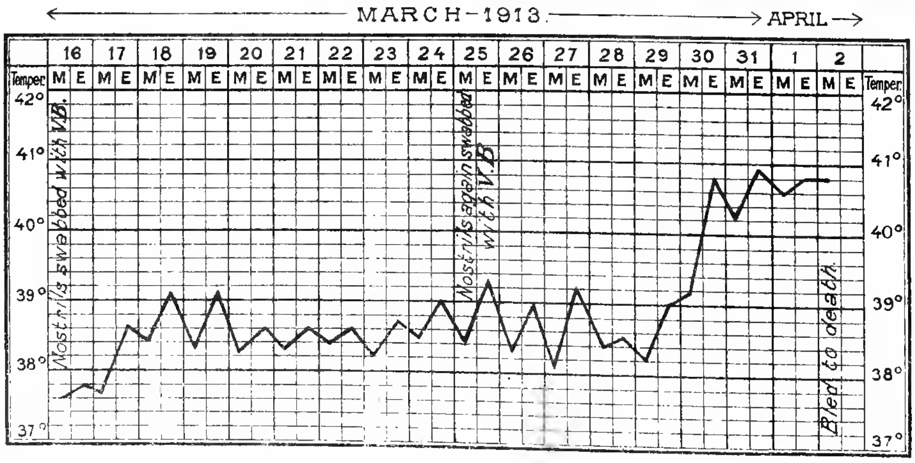


TABLE No. 2.—Experiments to determine the Infectivity of Cattle Plague Blood when given by the Mouth.

EXPERIMENT No. 57.

On August 21, 1912, Cyprus No. 1962 was drrenched with 1 c.c. of virulent blood, from Cyprus No. 1955, in a litre of saline solution, and was isolated in the Commission stables.

No reaction.

On September 1, 1912, received virulent blood.

On September 5, 1912, had a rise of temperature.

On September 8, 1912, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Negative. Did not contract the disease from the blood drench, although afterwards found to be susceptible when inoculated subcutaneously with virulent blood.

EXPERIMENT No. 98.

On October 23, 1912, Cyprus No. 2037 was drenched with 1 c.c. of virulent blood in a half-litre of water.

On October 23 (evening), 1912, had a rise of temperature which lasted five days.

On October 28, 1912, he died.

Post-mortem.—Cattle Plague.

Result.—As the rise of temperature took place on the evening of the day on which the drench was given, the disease was undoubtedly the result of accidental infection contracted before the drench was given.

This animal had been used in a previous experiment (Exp. No. 77) when he was isolated in a loose box in the Animal Isolation Hospital. When he was given the drench he was allowed to remain in this box, but in the meantime an animal in an adjoining box had developed cattle plague, so that there was a definite risk of accidental infection.

EXPERIMENT No. 120.

On February 9, 1913, Cyprus No. 2400 was drenched with 1 c.c. of virulent blood, from Cyprus No. 2376, in a half-litre of water, and was isolated in the Commission stable No. 7.

No reaction.

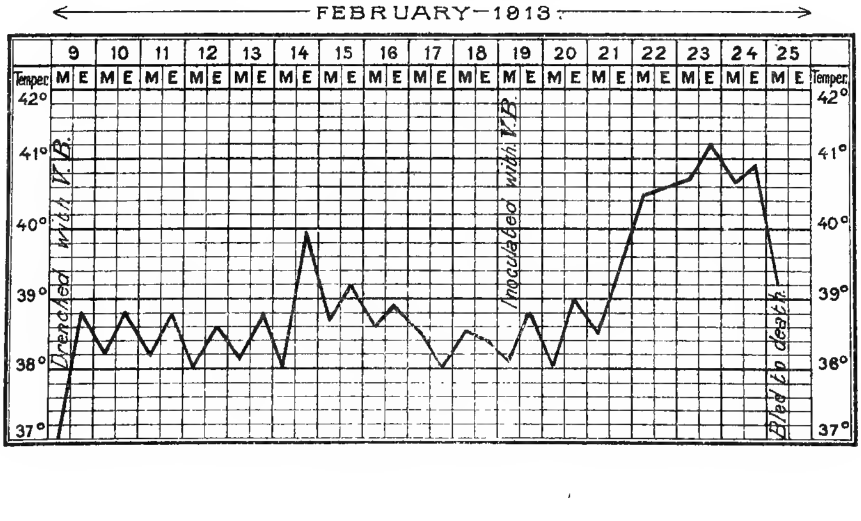
On February 19, 1913, was tested with virulent blood.

On February 22, 1913, had a rise of temperature.

On February 25, 1913, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Negative. Did not contract the disease from the blood drench, although afterwards found to be susceptible when tested with virulent blood.



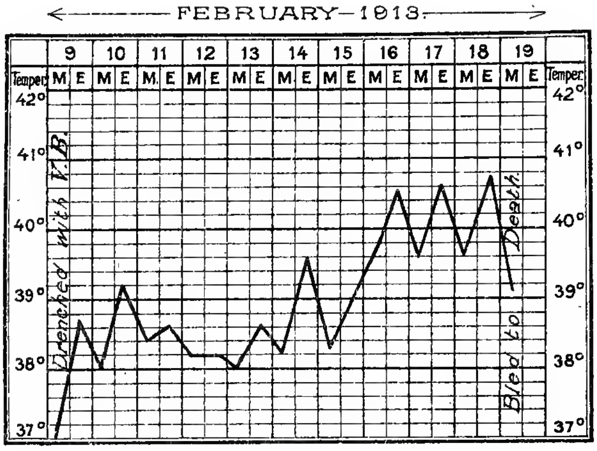
On February 9, 1913, Cyprus No. 2401 was drenched with 1 c.c. of virulent blood, from Cyprus No. 2376, in a half-litre of saline solution, and was isolated in the Commission stable No. 7.

On February 14. 1913, had a rise of temperature.

On February 19, 1913, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.



EXPERIMENT No. 46.

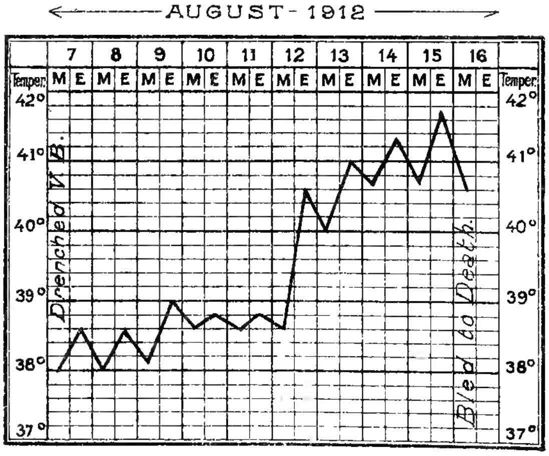
On August 7, 1912, Cyprus No. 1936 was drenched with 5 c.c. of virulent blood, from Cyprus No. 1932, in a litre of saline solution, and was isolated in the Commission stables.

On August 12, 1912, had a rise of temperature.

On August 16, 1912, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.



Experiment No. 99.

On October 23, 1912, Cyprus No. 2143 was drenched with 5 c.c. of virulent blood, from Cyprus No. 2094, in a half-litre of water, and was isolated in Animal Infectious Hospital.

On October 31, 1912, had a rise of temperature.

On November 3, 1912, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

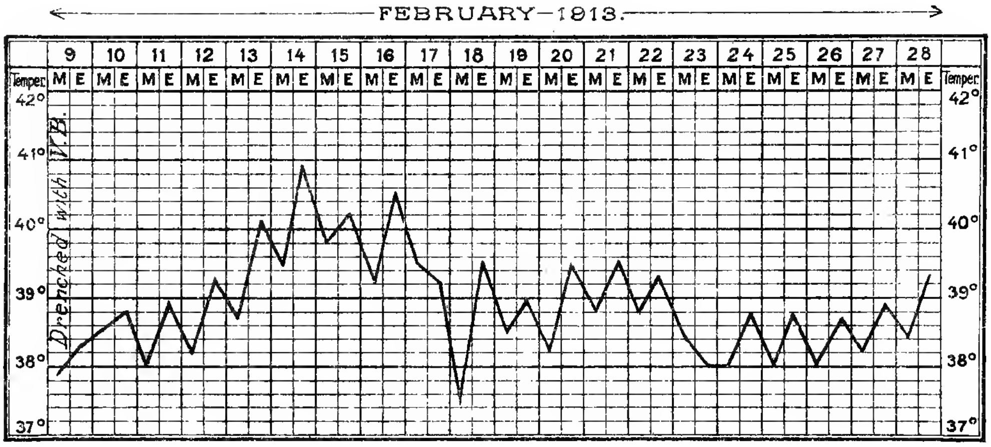
Result.—Uncertain. The animal contracted the disease, but there was a possibility of accidental isolation owing to the existence of a case of cattle plague in the same block of stables at this time.

Experiment No. 121.

On February 9, 1913, Cyprus No. 2402 was drenched with 5 c.c. of virulent blood, from Cyprus No. 2376, in a half-litre of water, and was isolated in the Commission stable No. 1.

On February 13, 1913, had a rise of temperature, and was isolated outside the stable.

Result.—Positive. Contracted the disease but recovered.



On February 9, 1913, Cyprus No. 2403 was drenched with 5 c.c. of virulent blood, from Cyprus No. 2376, in a half-litre of saline solution, and was isolated in the Commission stable No. 1.

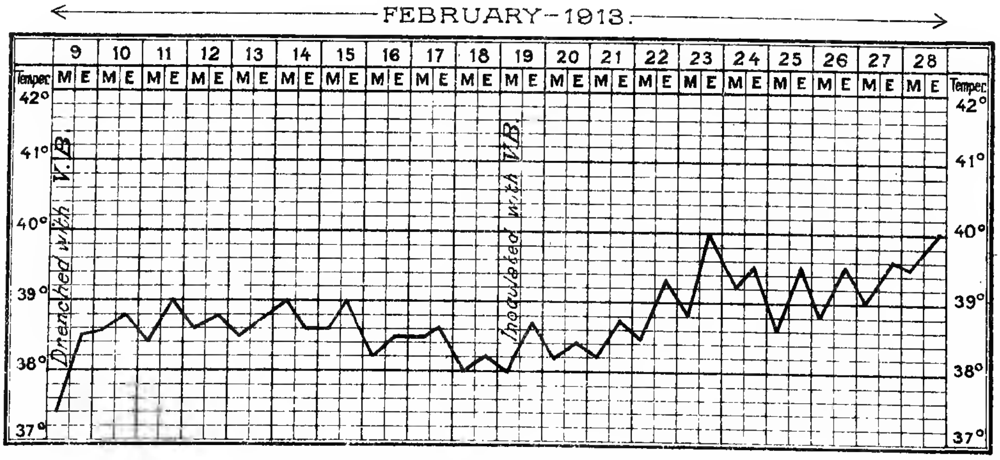
No reaction.

On February 19, 1913, was tested with virulent blood.

On February 23, 1913, had a rise of temperature.

Recovered.

Result.—Negative. Did not contract the disease, but on subsequent inoculation with virulent blood, contracted a mild attack of the disease and recovered.



EXPERIMENT No. 39.

On July 25, 1912, Cyprus No. 1927 was drenched with 500 c.c. of virulent blood, from Cyprus No. 1856, and was isolated in the Commission stables.

On July 29, 1912, had a rise of temperature.

On July 31, 1912, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.

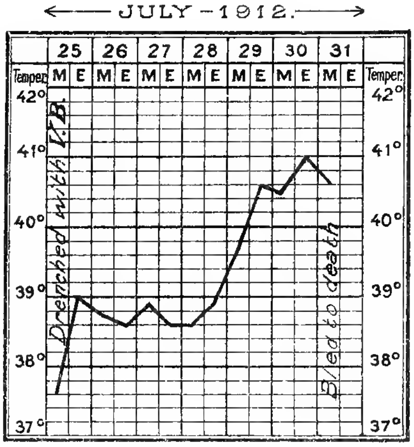


TABLE No. 3.—**Experiments to determine the Infectivity of Cattle Plague Blood when applied to Vagina.**

EXPERIMENT No. 207.

On July 6, 1913, Cyprus cow No. 2823 had her vagina swabbed (freely) with non citrated virulent blood and was isolated in the Commission stable No. 7.

No reaction.

On August 14, 1913, was simultaneously inoculated with 2 c.c. virulent blood and 54 c.c. serum.

On August 18, 1913, had a rise of temperature. Recovered.

Result.—Negative. Did not contract the disease from the blood smear, although afterwards found to be susceptible when simultaneously inoculated.

EXPERIMENT No. 209.

On July 17, 1913, Cyprus cow No. 2837 had her vagina swabbed (freely) with citrated virulent blood from Cyprus No. 2801.

No reaction.

On July 27, 1913, was tested with virulent blood.

On July 30, 1913, had a rise of temperature.

On August 2, 1913, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Negative. Did not contract the disease from the blood smear although afterwards found to be susceptible when tested with virulent blood.

On July 17, 1913, Cyprus cow No. 2840 had her vagina swabbed (freely) with citrated virulent blood from Cyprus No. 2801.

No reaction.

On July 27, 1913, was tested with virulent blood.

Irregular chart, but showed typical symptoms of cattle plague.

On August 3, 1913, was bled to death for virulent blood.

Result.—Negative. Did not contract the disease from the blood smear, although afterwards found to be susceptible when tested with virulent blood.

TABLE No. 4.—**Experiments to determine the Infectivity of Cattle Plague Blood when applied to Eyes.**

EXPERIMENT No. 74.

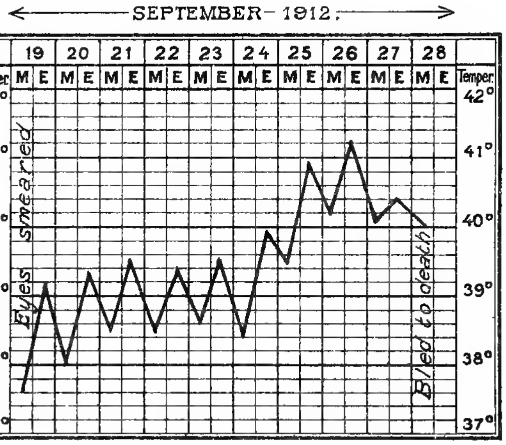
On September 19, 1912, Cyprus No. 2030 had both eyes smeared with virulent blood from Cyprus No. 2044 and was isolated in the Commission stables.

On September 24, 1912, had a rise of temperature.

On September 28, 1912, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.



EXPERIMENT No. 137.

On March 12, 1913, Cyprus No. 2465 had both eyes smeared with virulent blood from Cyprus No. 2432 and was isolated in the Commission stable No. 6.

On March 16, 1913, had a rise of temperature.

On March 20, 1913, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.

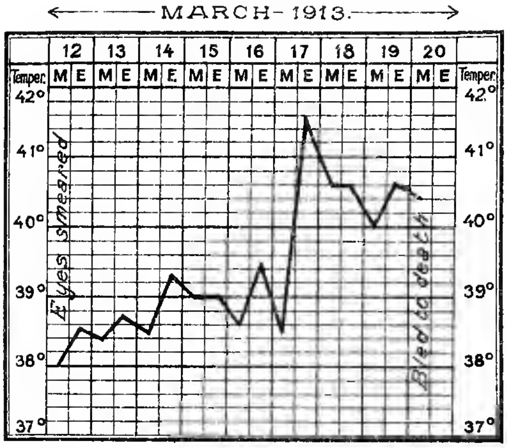


TABLE No. 5.—**Experiments with Centrifugalized Virulent Blood.**

EXPERIMENT No. 32.

On July 10, 1912, Cyprus Nos. 1886, 1885, 1857, 1884, 1859, 1900, and 1856, were inoculated with centrifugalized virulent blood as follows :—

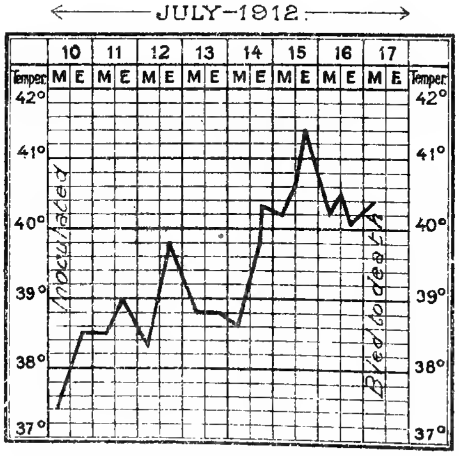
Cyprus No. 1886, inoculated subcutaneously with 5 c.c. bottom layer.

On July 14, 1912, had a rise of temperature.

On July 17, 1912, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

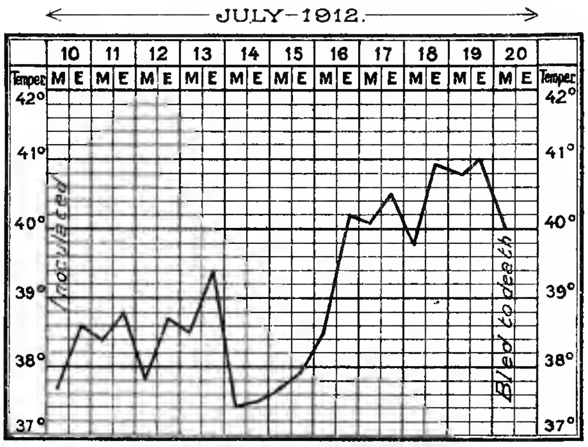
Result.—Positive. Contracted the disease.



Cyprus No. 1885, inoculated subcutaneously with 0·5 c.c. bottom layer.
On July 16, 1912, had a rise of temperature.
On July 20, 1912, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

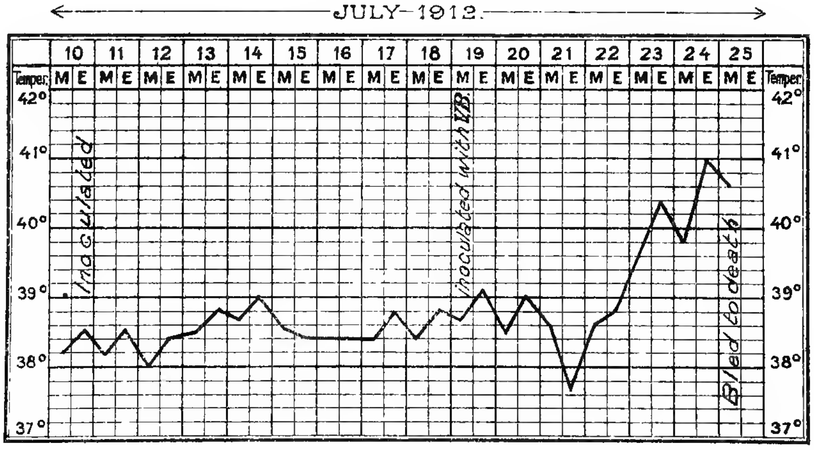
Result.—Positive. Contracted the disease.



Cyprus No. 1857, inoculated subcutaneously with 0·05 c.c. bottom layer.
No reaction.
On July 19, 1912, was tested with virulent blood.
On July 23, 1912, had a rise of temperature.
On July 25, 1912, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

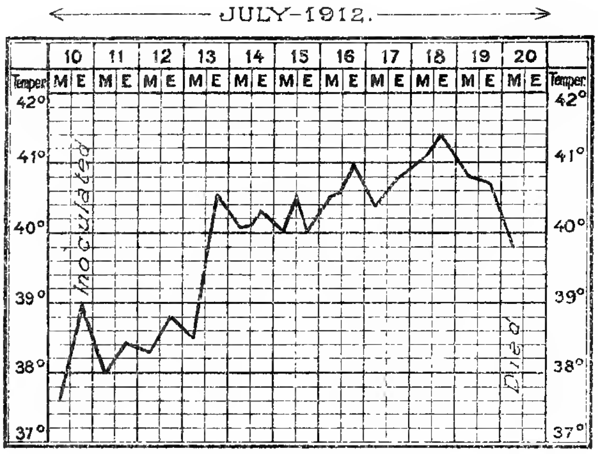
Result.—Negative. Did not contract the disease from the inoculation with centrifugalized virulent blood at the dose of 0·05 c.c., although afterwards found to be susceptible when tested with virulent blood.



Cyprus No. 1884, inoculated subcutaneously with 0·5 c.c. top layer.
On July 13, 1912, had a rise of temperature.
On July 20, 1912, died.

Post-mortem.—Cattle Plague.

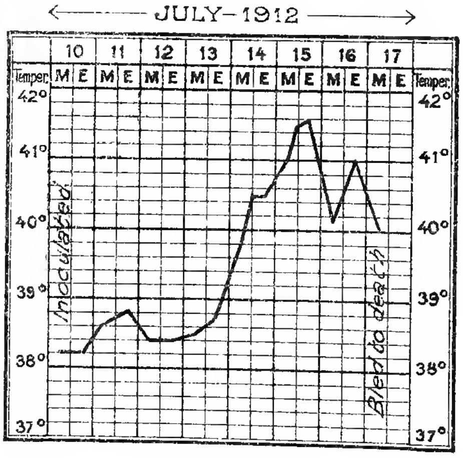
Result.—Positive. Contracted the disease.



Cyprus No. 1859, inoculated subcutaneously with 0·05 c.c. top layer.
On July 14, 1912, had a rise of temperature.
On July 17, 1912, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

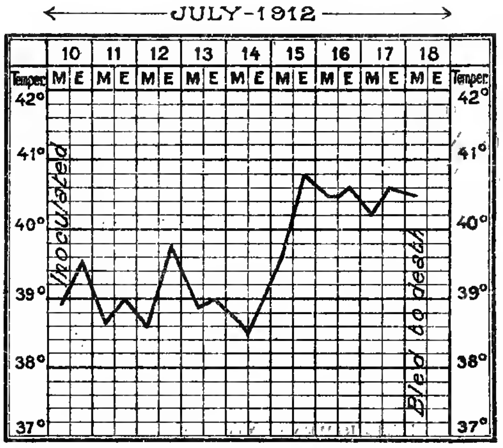
Result.—Positive. Contracted the disease.



Cyprus No. 1900, inoculated subcutaneously with 0·005 c.c. top layer.
On July 15, 1912, had a rise of temperature.
On July 18, 1912, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.



Cyprus No. 1856, inoculated subcutaneously with 0·0005 c.c. top layer.
No reaction.
On July 19, 1912, was tested with virulent blood.
On July 23, 1912, had a rise of temperature.
On July 25, 1912, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Negative. Did not contract the disease from the inoculation with centrifugalized virulent blood at the dose of 0·0005 c.c., although afterwards found to be susceptible when tested with virulent blood.

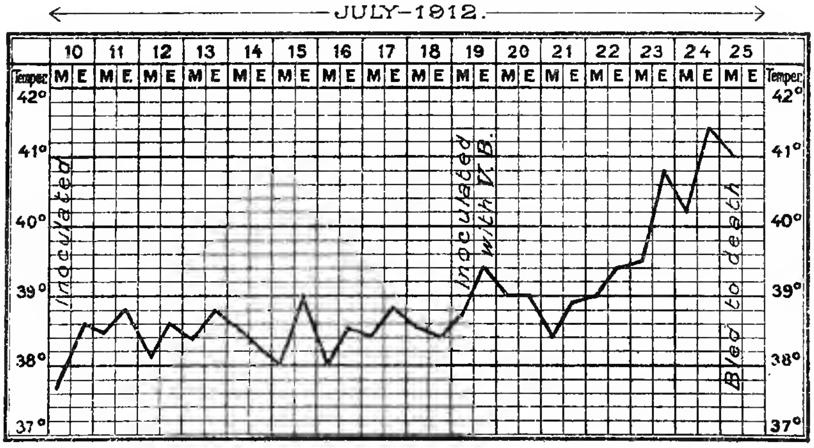


TABLE No. 6.—**Experiments with Centrifugalized Virulent Blood.**

EXPERIMENT No. 201.

On June 24, 1913, Cyprus Nos. 2763 and 2764 were inoculated subcutaneously with 1 c.c. each of the citrated plasma of virulent blood and were isolated in the Commission stable No. 7.

No reaction.

On July 6, 1913, were tested with virulent blood.

On July 8, 1913, Cyprus No. 2763 had a rise of temperature.

On July 9, 1913, Cyprus No. 2764 had a rise of temperature.

On July 12, 1913, were bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Negative. Did not contract the disease from the plasma inoculation, although afterwards both animals found to be susceptible when tested with virulent blood.

EXPERIMENT No. 197.

On June 5, 1913, Cyprus Nos. 2701, 2699, 2700, 2709, 2708, 2710, and 2703 were inoculated subcutaneously with centrifugalized virulent blood as follows :—

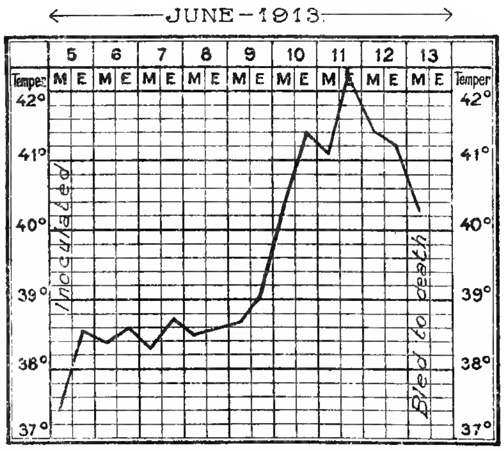
Cyprus No. 2701, inoculated subcutaneously with 5 c.c. bottom layer, and was isolated in Animal Isolation Hospital.

On June 10, 1913, had a rise of temperature.

On June 13, 1913, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.



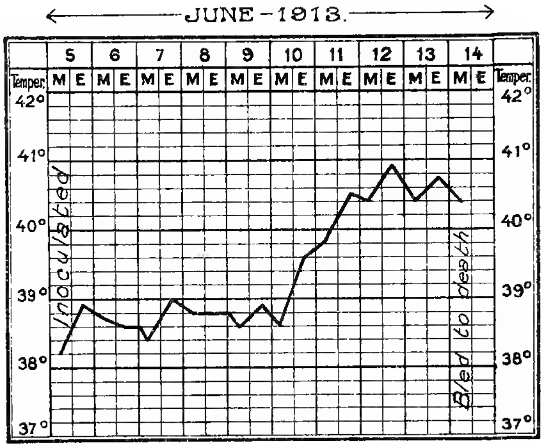
Cyprus No. 2699, inoculated subcutaneously with 0·5 c.c. bottom layer, and was isolated in Animal Isolation Hospital.

On June 10, 1913, had a rise of temperature.

On June 14, 1913, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.



Cyprus No. 2700, inoculated subcutaneously with 0·05 c.c. bottom layer, and was isolated in Animal Isolation Hospital.

No reaction.

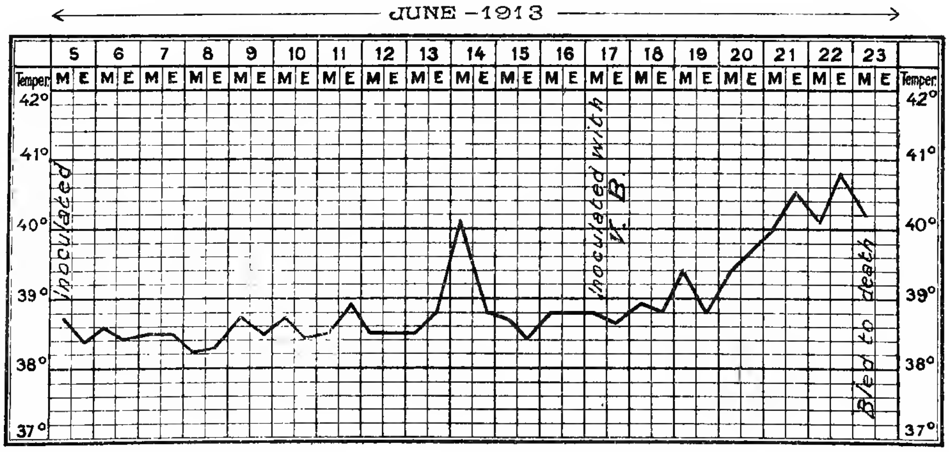
On June 17, 1913, was tested with virulent blood.

On June 21, 1913, had a rise of temperature.

On June 23, 1913, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Negative. Did not contract the disease from the inoculation with centrifugalized virulent blood at the dose of 0·05 c.c., although afterwards found to be susceptible when tested with virulent blood.



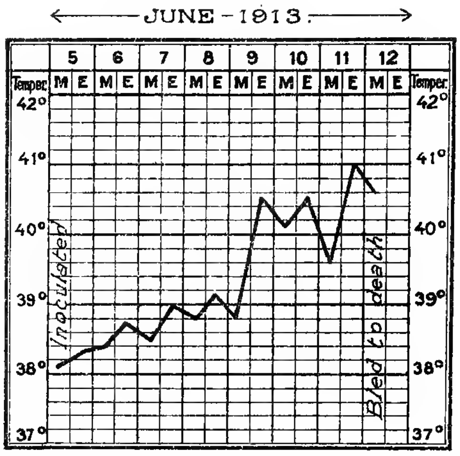
Cyprus No. 2709, inoculated subcutaneously with 0·5 c.c. top layer, and was isolated in the Commission stable No. 6.

On June 9, 1913, had a rise of temperature.

On June 12, 1913, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.



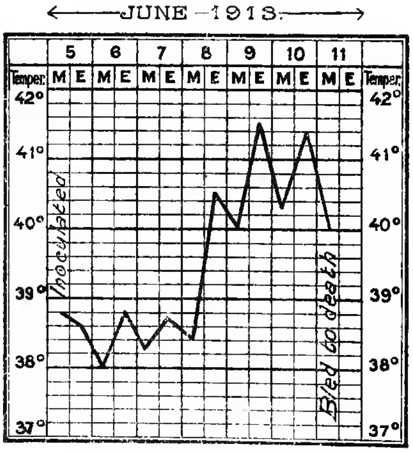
Cyprus No. 2708, inoculated subcutaneously with 0·05 c.c. top layer, and was isolated in the Commission stable No. 5.

On June 8, 1913, had a rise of temperature.

On June 11, 1913, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.



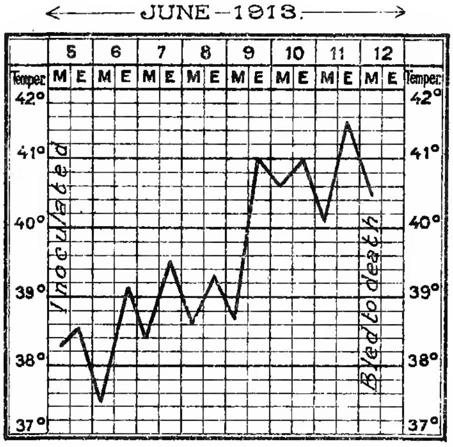
Cyprus No. 2710, inoculated subcutaneously with 0·005 c.c. top layer, and was isolated in the Commission stable No. 4.

On June 9, 1913, had a rise of temperature.

On June 12, 1913, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.



Cyprus No. 2703, inoculated subcutaneously with 0·0005 c.c. top layer and was isolated in the Commission stable No. 3.

Doubtful reaction.

On June 20, 1913, was tested with virulent blood.

No reaction.

On July 2, 1913, was tested with 10 c.c. virulent blood.

No reaction.

Result.—Uncertain. The animal had a reaction and recovered. Afterwards, when tested with virulent blood, he was found to be immune. It is highly probable that this was a positive reaction in a partially immune animal.

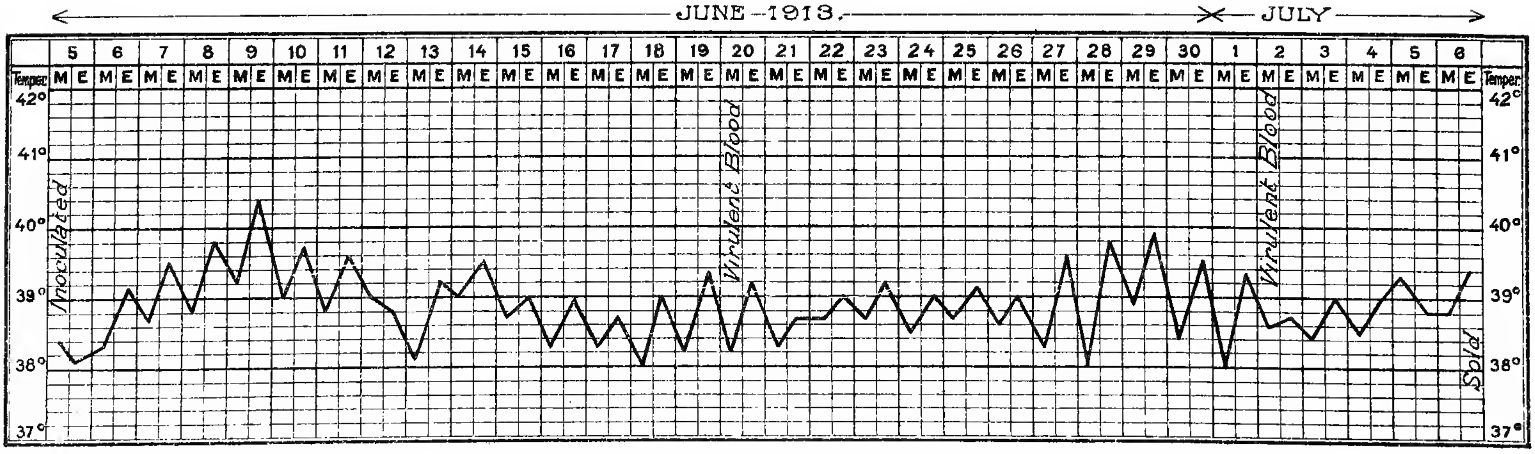


TABLE No. 7.—**Experiments with Virulent Blood (Cold Storage).**

EXPERIMENT No. 154.

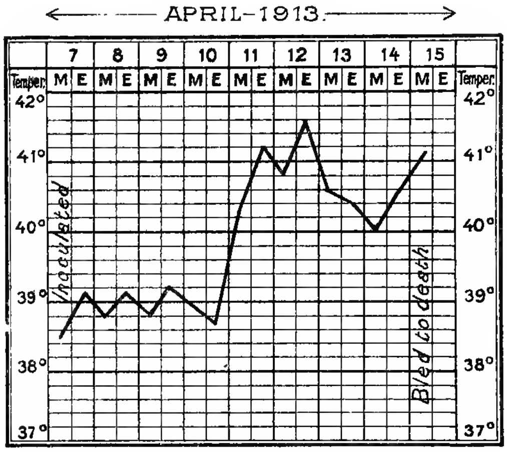
On April 7, 1913, Cyprus No. 2522 was inoculated subcutaneously with 5 c.c. virulent blood which had been kept in the Cold Storage for one week, and was isolated in the Commission stable No. 2.

On April 11, 1913, had a rise of temperature.

On April 15, 1913, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.



EXPERIMENT No. 162.

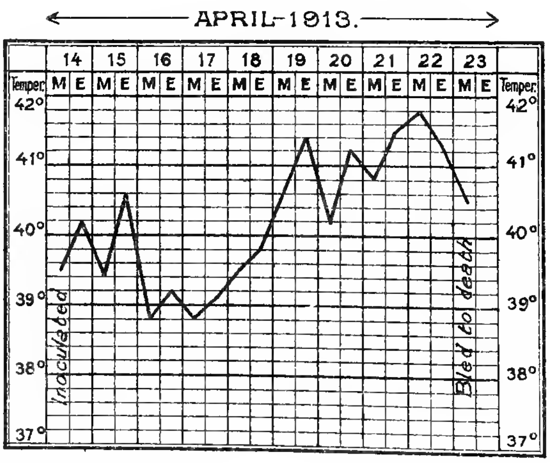
On April 14, 1913, Cyprus No. 2554 was inoculated subcutaneously with 5 c.c. virulent blood which had been kept in the Cold Storage for two weeks, and was isolated in the Commission stable No. 6.

On April 18, 1913, had a rise of temperature.

On April 23, 1913, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.



Experiment No. 164.

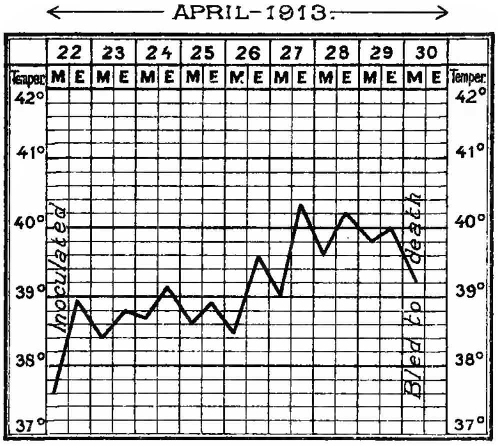
On April 22, 1913, Cyprus No. 2577 was inoculated subcutaneously with 5 c.c. virulent blood which had been kept in the Cold Storage for three weeks, and was isolated in the Commission stable No. 4.

On April 26, 1913, had a rise of temperature.

On April 30, 1913, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.



Experiment No. 175.

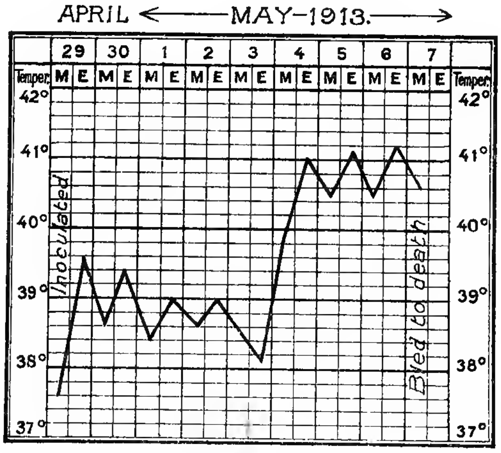
On April 29, 1913, Cyprus No. 2609 was inoculated subcutaneously with 5 c.c. virulent blood which had been kept in the Cold Storage for four weeks, and was isolated in the Commission stable No. 9.

On May 4, 1913, had a rise of temperature.

On May 11, 1913, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.



EXPERIMENT No. 181.

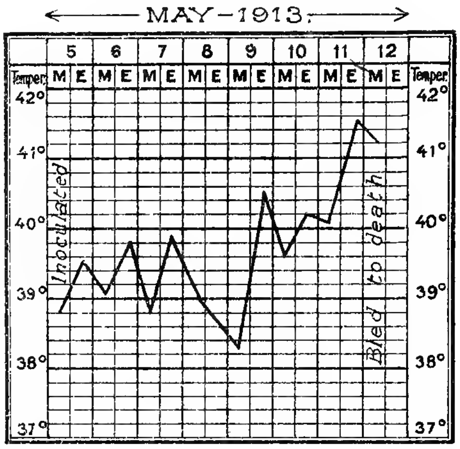
On May 5, 1913, Cyprus No. 2620 was inoculated subcutaneously with 5 c.c. virulent blood which had been kept in the Cold Storage for five weeks, and was isolated in the Commission stable No. 2.

On May 9, 1913, had a rise of temperature.

On May 12, 1913, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.



EXPERIMENT No. 184.

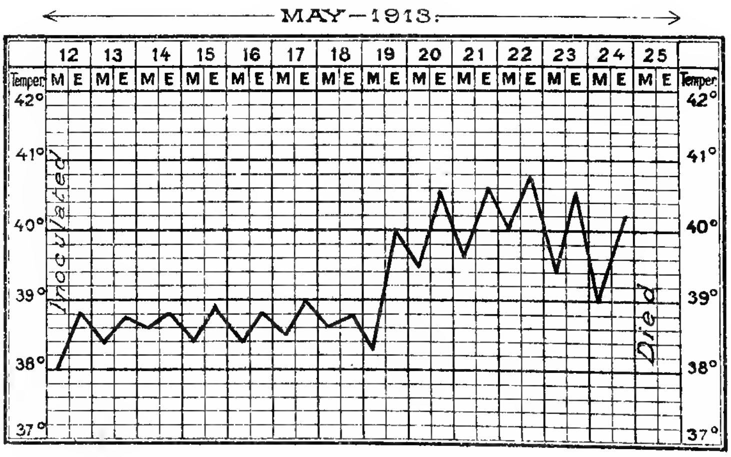
On May 12, 1913, Cyprus No. 2635 was inoculated subcutaneously with 5 c.c. virulent blood which had been kept in the Cold Storage for six weeks, and was isolated in the Commission stable No. 3.

On May 19, 1913, had a rise of temperature.

On May 25, 1913, died.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.



EXPERIMENT No. 190.

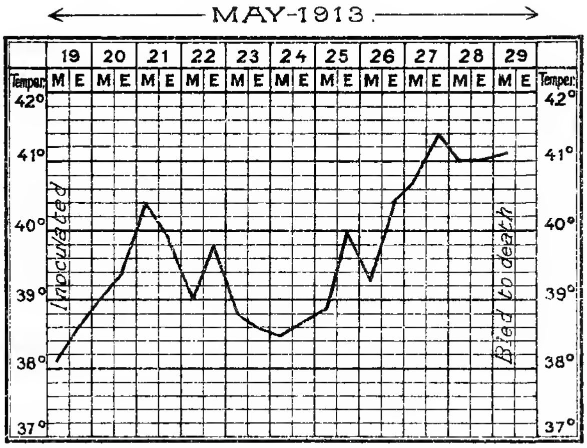
On May 19, 1913, Cyprus No. 2261 was inoculated subcutaneously with 5 c.c. virulent blood which had been kept in the Cold Storage for seven weeks, and was isolated in the Commission stable No. 1.

On May 25, 1913, had a rise of temperature.

On May 29, 1913, was bled to death for virulent blood.

Post-mortem.—Cattle Plague. Blood films showed Texas fever parasites.

Result.—Positive. Contracted the disease.



EXPERIMENT No. 193.

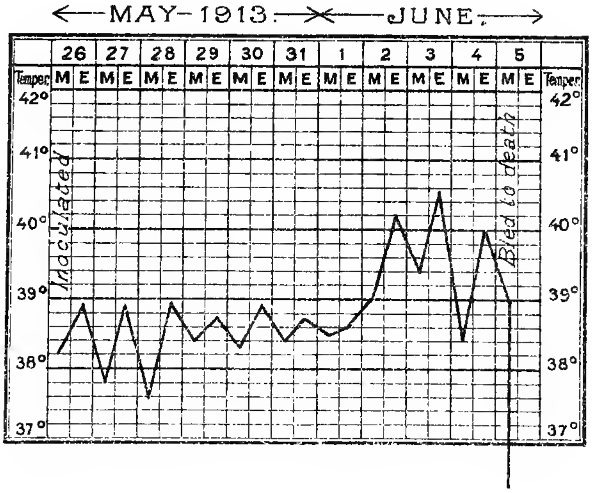
On May 26, 1913, Cyprus No. 2681 was inoculated subcutaneously with 5 c.c. virulent blood which had been kept in the Cold Storage for eight weeks, and was isolated on the desert.

On June 2, 1913, had a rise of temperature.

On June 5, 1913, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.



EXPERIMENT No. 196.

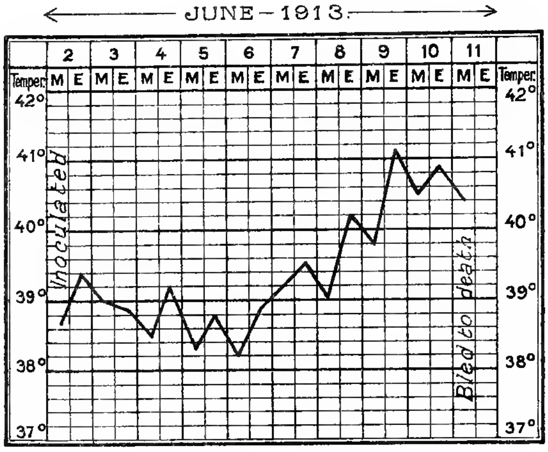
On June 2, 1913, Cyprus No. 2692 was inoculated subcutaneously with 5 c.c. virulent blood which had been kept in the Cold Storage for nine weeks, and was isolated in the Commission stable No. 7.

On June 8, 1913, had a rise of temperature.

On June 11, 1913, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.



EXPERIMENT No. 199.

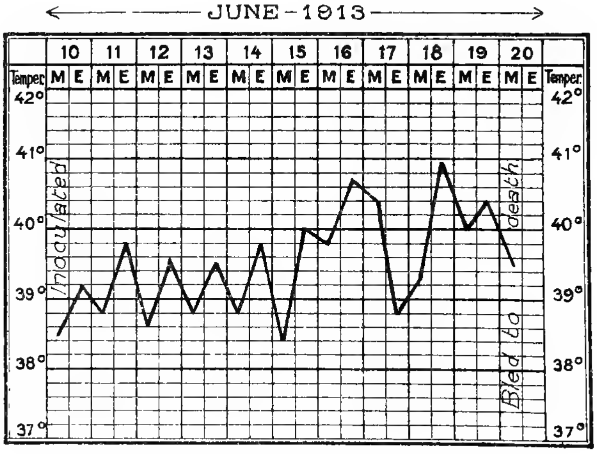
On June 10, 1913, Cyprus No. 2730 was inoculated subcutaneously with 5 c.c. virulent blood which had been kept in the Cold Storage for ten weeks, and was isolated in the wire stable.

On June 15, 1913, had a rise of temperature.

On June 20, 1913, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.



EXPERIMENT No. 200.

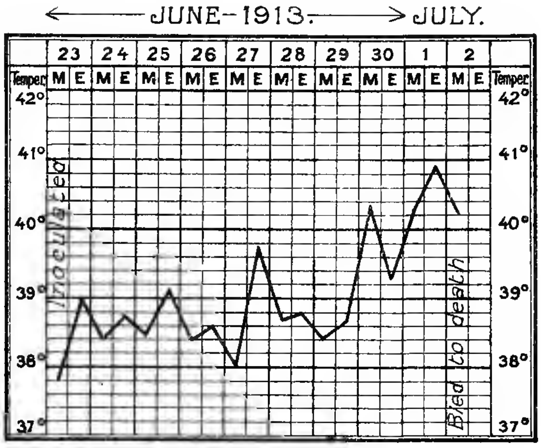
On June 23, 1913, Cyprus No. 2791 was inoculated subcutaneously with 5 c.c. virulent blood which had been kept in the Cold Storage for twelve weeks, and was isolated on the desert.

On June 30, 1913, had a rise of temperature.

On July 2, 1913, was bled to death for virulent blood.

Post-mortem.—Cattle Plague. Blood films showed Egyptian fever parasites.

Result.—Positive. Contracted the disease.



EXPERIMENT No. 202.

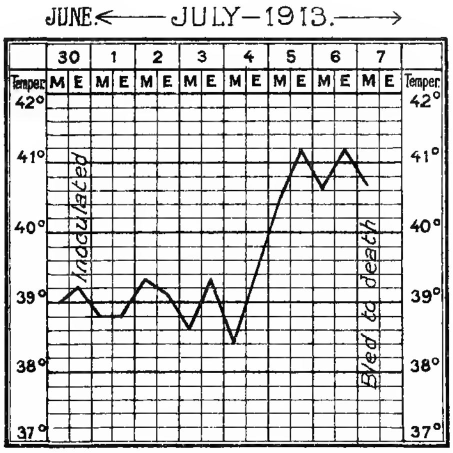
On June 30, 1913, Cyprus No. 2770 was inoculated subcutaneously with 5 c.c. virulent blood which had been kept in the Cold Storage for thirteen weeks, and was isolated in the Commission stable No. 8.

On July 5, 1913, had a rise of temperature.

On July 7, 1913, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.



Experiment No. 208.

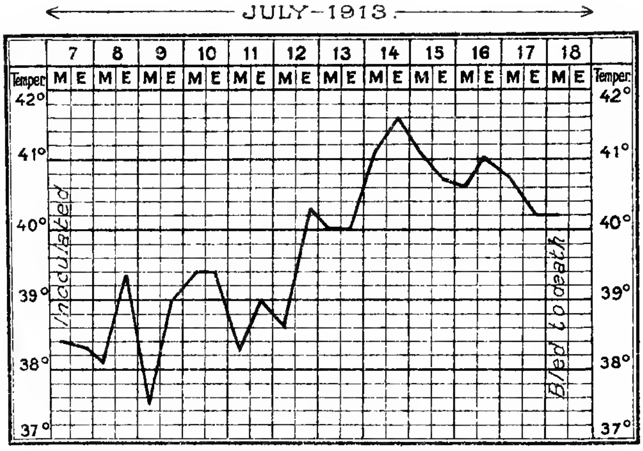
On July 7, 1913, Cyprus No. 2794 was inoculated subcutaneously with 5 c.c. virulent blood which had been kept in the Cold Storage for fourteen weeks, and was isolated on the desert.

On July 12, 1913, had a rise of temperature.

On July 18, 1913, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.



Experiment No. 210.

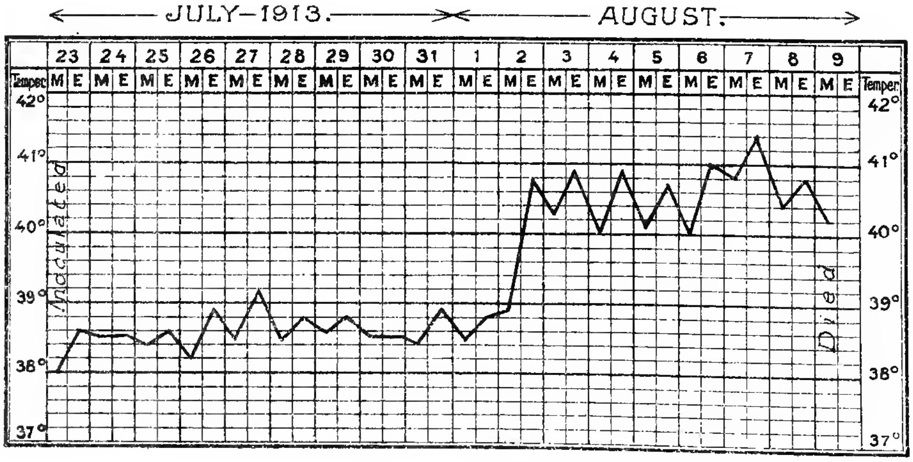
On July 23, 1913, Cyprus No. 2859 was inoculated subcutaneously with 5 c.c. virulent blood which had been kept in the Cold Storage for sixteen weeks, and was isolated in the Commission stable No. 5.

On August 2, 1913, had a rise of temperature.

On August 9, 1913, died.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.



EXPERIMENT No. 211.

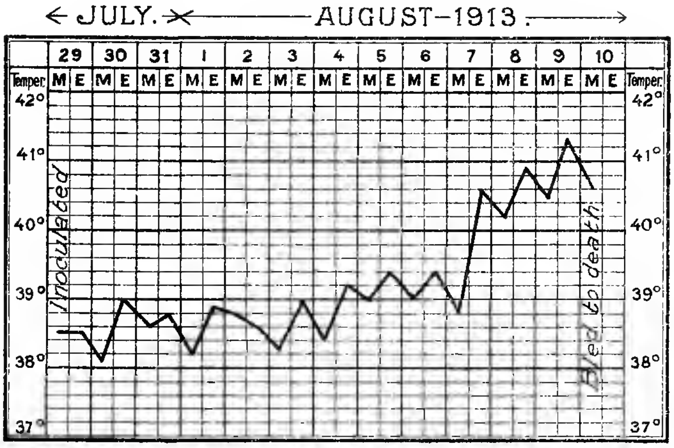
On July 29, 1913, Cyprus No. 2860 was inoculated subcutaneously with 5 c.c. virulent blood which had been kept in the Cold Storage for seventeen weeks, and was isolated in the Commission stable No. 5.

On August 7, 1913, had a rise of temperature.

On August 10, 1913, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.



EXPERIMENT No. 216.

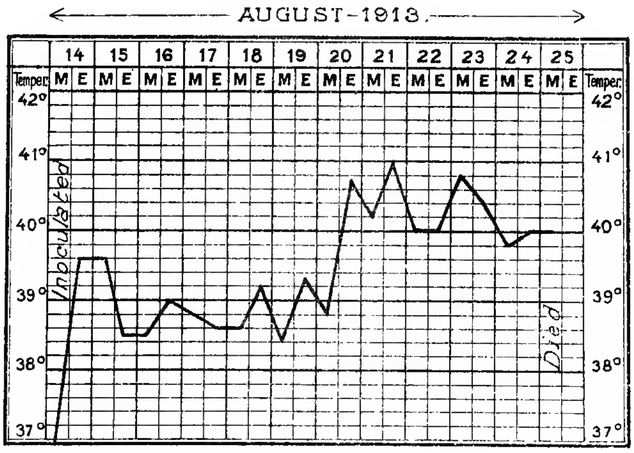
On August 14, 1913, Cyprus No. 2918 was inoculated subcutaneously with 5 c.c. virulent blood which had been kept in the Cold Storage for nineteen weeks, and was isolated in the Commission stable No. 7.

On August 20, 1913, had a rise of temperature.

On August 25, died.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.



EXPERIMENT No. 223.

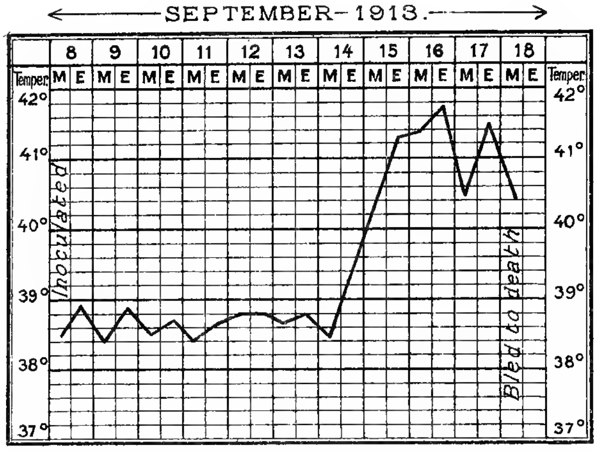
On September 8, 1913, Cyprus No. 2967 was inoculated subcutaneously with 5 c.c. virulent blood which had been kept in the Cold Storage for twenty-two weeks, and was isolated in the Commission stable No. 6.

On September 14, 1913, had a rise of temperature.

On September 18, 1913, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.



EXPERIMENT No. 236.

On October 19, 1913, Cyprus No. 3042 was inoculated subcutaneously with 5 c.c. virulent blood which had been kept in the Cold Storage for twenty-nine weeks, and was isolated in the Commission stable No. 5.

On October 28, 1913, had a rise of temperature.

On November 2, 1913, his temperature returned to normal (recovered).

On November 6, 1913, received virulent blood.

No reaction.

Result.—Positive. Contracted the disease.

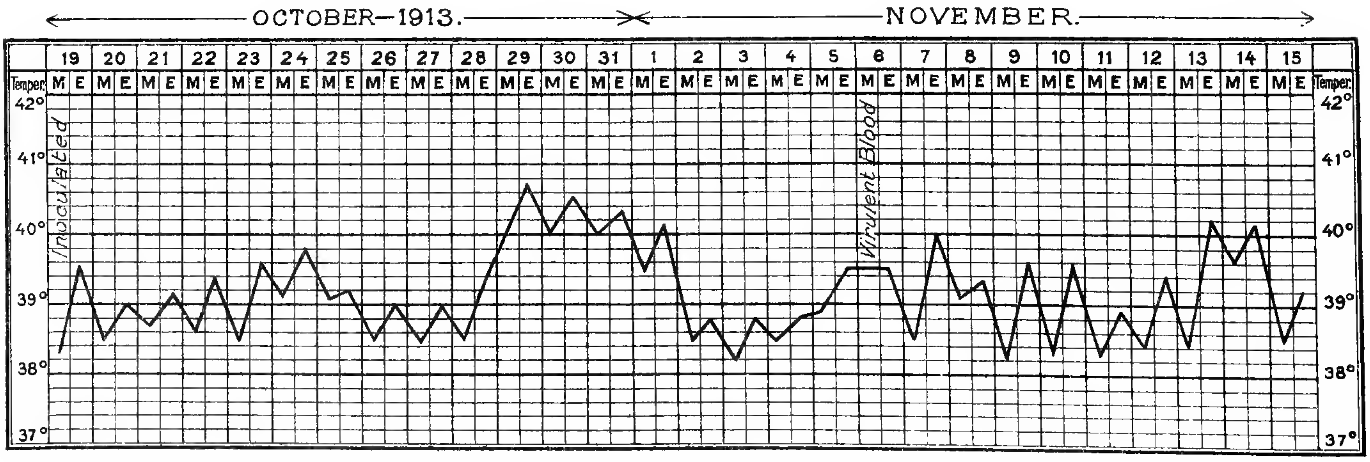


TABLE No. 8.—Experiments to determine the Infectivity of Cattle Plague Lymph when Inoculated Subcutaneously.

EXPERIMENT No. 233.

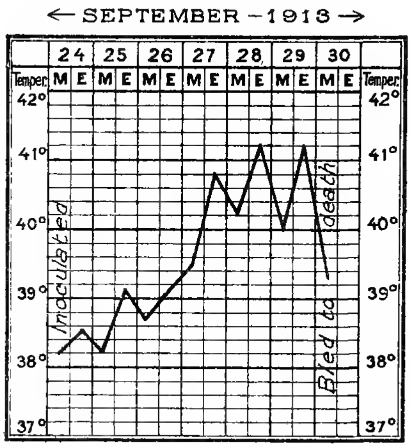
On September 24, 1913, Cyprus No. 3003 was inoculated subcutaneously with 0·5 c.c. of the lymph taken from the thoracic duct of a Cattle Plague animal.

On September 27, 1913, had a rise of temperature.

On September 30, 1913, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.



EXPERIMENT No. 234.

On September 25, 1913, Cyprus No. 3006 was inoculated subcutaneously with 2 c.c. of the lymph taken from the thoracic duct of a Cattle Plague animal.

On September 29, 1913, had a rise of temperature.

On October 2, 1913, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.

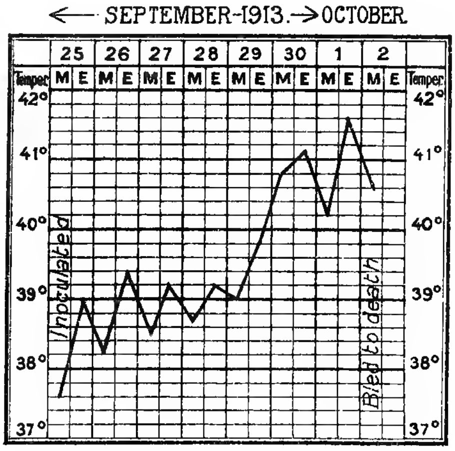


Table No. 9.—**Experiments to determine the Degree of Virulence of Cattle Plague Lymph.**

Experiment No. 240.

On November 8, 1913, the following animals were inoculated subcutaneously with different amounts of the lymph taken from the thoracic duct of a Cattle Plague animal (six days after inoculation with virulent blood) :—

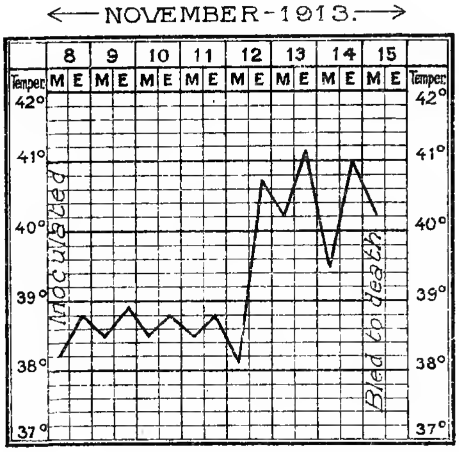
Cyprus No. 3109, inoculated subcutaneously with 0·1 c.c. lymph of a Cattle Plague animal.

On November 12, 1913, had a rise of temperature.

On November 15, 1913, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.



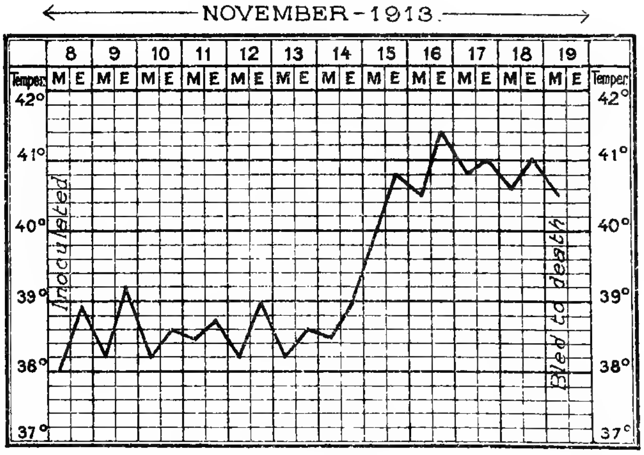
Cyprus No. 3107, inoculated subcutaneously with 0·03 c.c. lymph of a Cattle Plague animal.

On November 15, 1913, had a rise of temperature.

On November 19, 1913, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.



Cyprus No. 3106, inoculated subcutaneously with 0·01 c.c. lymph of a Cattle Plague animal.

No reaction.

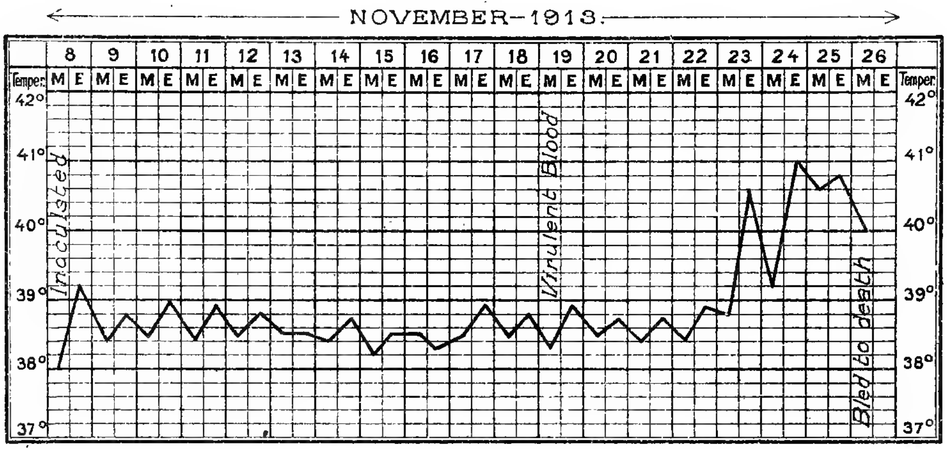
On November 19, 1913, was tested with virulent blood.

Reaction.

On November 25, 1913, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Negative. Did not contract the disease from the lymph inoculation at the dose of 0·01 c.c., although afterwards found to be susceptible when tested with virulent blood.



Cyprus No. 3104, inoculated subcutaneously with 0·003 c.c. lymph from a Cattle Plague animal.

No reaction.

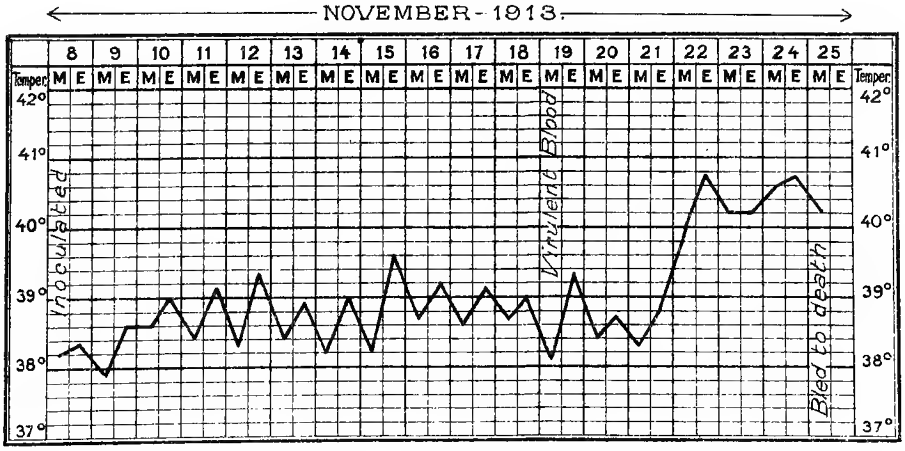
On November 19, 1913, was tested with virulent blood.

Reaction.

On November 25, 1913, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Negative. Did not contract the disease from the lymph inoculation at the dose of 0·003 c.c., although afterwards found to be susceptible when tested with virulent blood.



Cyprus No. 3103, inoculated subcutaneously with 0·001 c.c. lymph of a Cattle Plague animal.

No reaction.

On November 21, 1913, was tested with virulent blood.

Reaction.

On November 27, 1913, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Negative. Did not contract the disease from the lymph inoculation at the dose of 0·001 c.c. although afterwards found to be susceptible when tested with virulent blood.

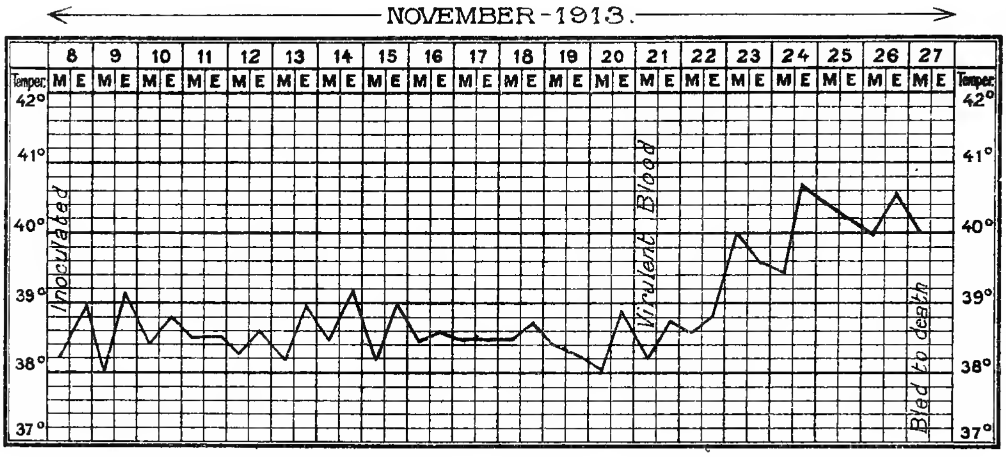


TABLE NO. 10.—Experiments to determine the Infectivity of Cattle Plague Lymph when applied to Mucous Surfaces.

EXPERIMENT NO. 225.

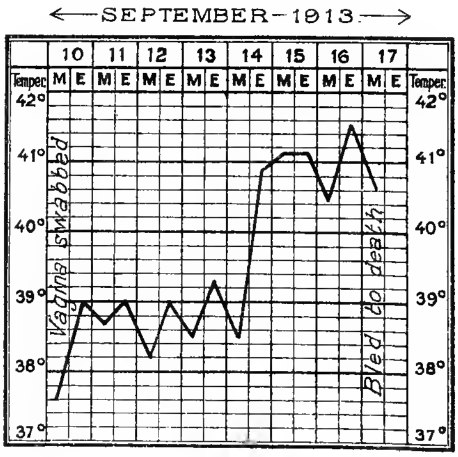
On September 10, 1913, Cyprus No. 2999 had the vagina swabbed with lymph taken from the thoracic duct of a Cattle Plague animal.

On September 14, 1913, had a rise of temperature.

On September 17, 1913, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.



Experiment No. 228.

On September 11, 1913, Cyprus No. 3008 had the vagina swabbed with lymph taken from the tharacic duct of a Cattle Plague animal.

On September 15, 1913, had a rise of temperature.

On September 20, 1913, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.

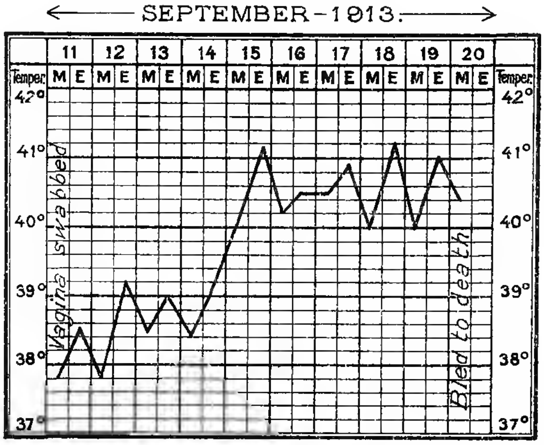


Table No. 11.—**Experiments to determine the Infectivity of the Flesh of Animals suffering from Cattle Plague.**

Experiment No. 49.

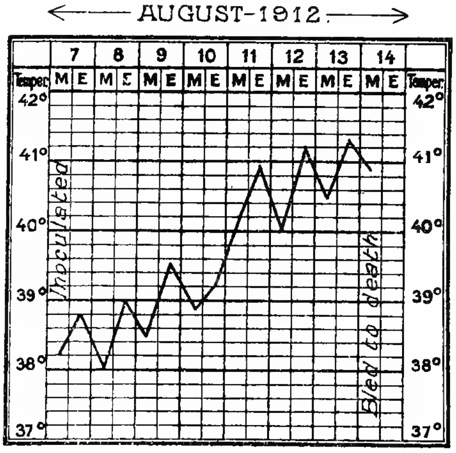
On August 7, 1912, Cyprus No. 1939 was inoculated subcutaneously with 5 c.c. meat emulsion from Cyprus No. 1932, and was isolated inside the Serum Institute compound.

On August 11, 1912, had a rise of temperature.

On August 14, 1912, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.



EXPERIMENT No. 122.

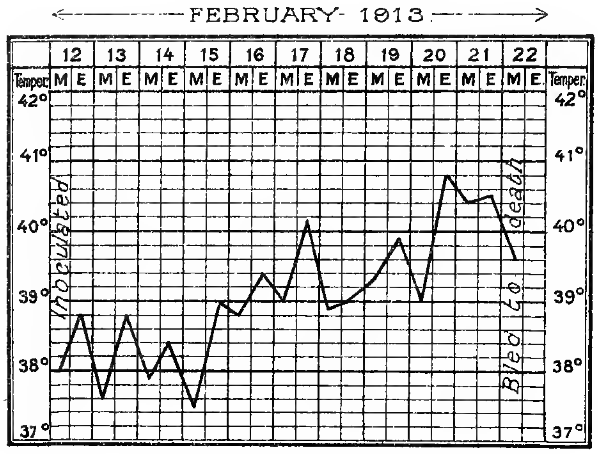
On February 12, 1913, Cyprus No. 2396 was inoculated subcutaneously with 10 c.c. meat emulsion from Cyprus No. 2274 and was isolated in horse-box.

On February 17, 1913, had a rise of temperature.

On February 22, 1913, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.



EXPERIMENT No. 148.

On March 31, 1913, Cyprus No. 2505 was inoculated subcutaneously with 5 c.c. meat emulsion from Cyprus No. 2500 and was isolated.

On April 4, 1913, had a rise of temperature.

On April 6, 1913, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.

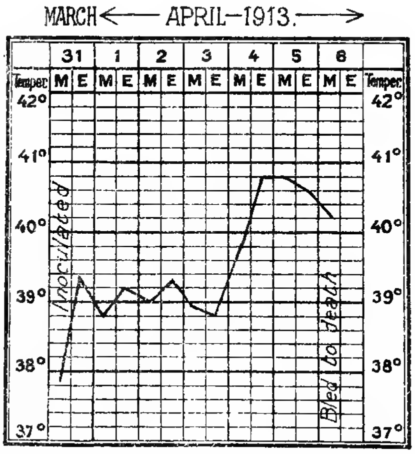


TABLE No. 12.—**Experiments to determine the Infectivity of the Flesh of Animals suffering from Cattle Plague.**

EXPERIMENT No. 48.

On August 7, 1912, Cyprus No. 1937 had his nostrils swabbed with fresh meat emulsion from Cyprus No. 1932 (bled to death the sixth day after inoculation with virulent blood), and was isolated in the Commission stables.

From August 7 to 18, 1912, remained normal.

On August 18, 1912, was tested with virulent blood.

On August 20, 1912, had a rise of temperature.

On August 22, 1912, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Negative. Did not contract the disease from the meat emulsion smear, although afterwards found to be susceptible when tested with virulent blood.

EXPERIMENT No. 238.

On October 30, 1913, Cyprus cow No. 3064 had her vagina swabbed with fresh meat emulsion from Cyprus No. 3084 and was isolated in the Commission stable No. 7.

No reaction.

On November 8, 1913, was tested with virulent blood.

On November 10, 1913, had a rise of temperature.

On November 14, 1913, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Negative. Did not contract the disease from the meat emulsion smear, although afterwards found to be susceptible when tested with virulent blood.

TABLE No. 13.—**Experiments to determine the Infectivity of the Flesh of Animals suffering from Cattle Plague (Cold Storage).**

EXPERIMENT No. 53.

On August 15, 1912, Cyprus No. 1954 was inoculated subcutaneously with 5 c.c. meat emulsion made from Cattle Plague meat kept in the Cold Storage for one week, and was isolated in the Commission stables.

No reaction.

On September 1, 1912, was tested with virulent blood.

On September 7, 1912, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Negative. Did not contract the disease from the meat emulsion, although afterwards found to be susceptible when tested with virulent blood.

Experiment No. 59.

On August 21, 1912, Cyprus No. 1969, was inoculated subcutaneously with 5 c.c. meat emulsion from Cattle Plague meat kept in the Cold Storage for two weeks. Isolated in the Commission stables.

No reaction.

On September 1, 1912, was tested with virulent blood.

On September 7, 1912, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Negative. Did not contract the disease from the meat emulsion inoculation, although afterwards found to be susceptible when tested with virulent blood.

Experiment No. 62.

On August 28, 1912, Cyprus No. 1988 was inoculated subcutaneously with 5 c.c. meat emulsion made from Cattle Plague meat kept in the Cold Storage for three weeks. Isolated in the Commission stables.

No reaction.

On September 5, 1912, was transferred to the clean side of the wire stable.

See experiment No. 71.

Result.—Negative. Did not contract the disease from the meat emulsion inoculation, although afterwards found to be susceptible when tested with virulent blood.

Experiment No. 69.

On September 4, 1912, Cyprus No. 1999 was inoculated subcutaneously with 5 c.c. meat emulsion made from Cattle Plague meat kept in the Cold Storage for four weeks.

No reaction.

On October 3, 1912, was inoculated subcutaneously with 10 c.c. blood from Goat No. 18 (*see* Experiment No. 81 *a*).

Result.—Negative. Did not contract the disease from the meat emulsion inoculation, although afterwards found to be susceptible when tested with virulent blood.

Experiment No. 86.

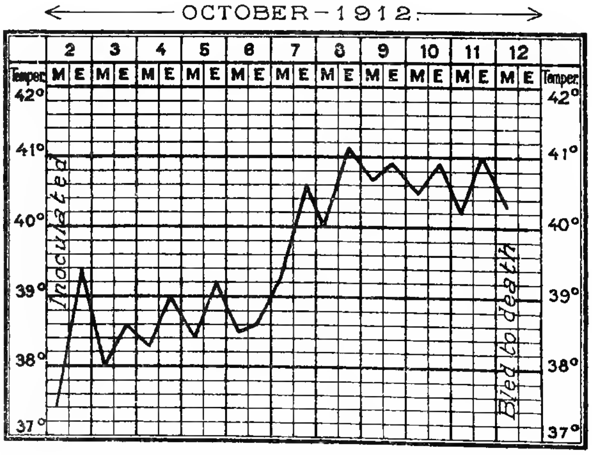
On October 2, 1912, Cyprus No. 2059 was inoculated subcutaneously with 5 c.c. meat emulsion made from Cattle Plague meat kept in the Cold Storage for six days. Isolated in the Commission stables.

On October 7, 1912, had a rise of temperature.

On October 12, 1912, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.



EXPERIMENT No. 91.

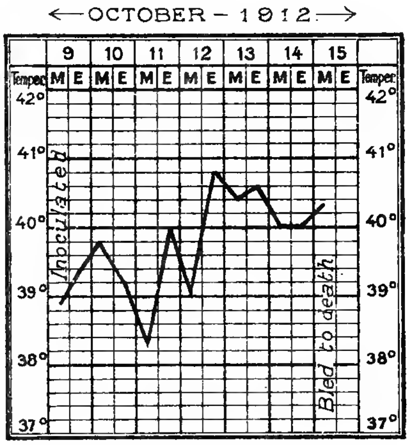
On October 9, 1912, Cyprus No. 2072 was inoculated subcutaneously with 5 c.c. meat emulsion made from Cattle Plague meat kept in the Cold Storage for thirteen days. Isolated in the Commission stables.

On October 12, 1912, had a rise of temperature.

On October 15, 1912, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.



EXPERIMENT No. 96.

On October 16, 1912, Cyprus No. 2102 was inoculated subcutaneously with 5 c.c. meat emulsion made from Cattle Plague meat kept in the Cold Storage for two weeks. Isolated in the Commission stables.

No reaction.

On November 10, 1912, was tested with virulent blood.

On November 16, 1912, was bled to death for virulent blood.

Post-mortem.—Cattle Plague and Egyptian Fever. Blood films showed Egyptian Fever parasites.

Result.—Negative. Did not contract the disease from the meat emulsion inoculation, although afterwards found to be susceptible when tested with virulent blood.

EXPERIMENT No. 124.

On February 28, 1913, Cyprus No. 2432 was inoculated subcutaneously with 5 c.c. meat emulsion made from Cattle Plague meat kept in the Cold Storage for fifteen days. Isolated in the Commission stable No. 7.

No reaction.

On March 6, 1913, was tested with virulent blood.

On March 8, 1913, had a rise of temperature.

On March 12, 1913, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Negative. Did not contract the disease from the meat emulsion inoculation, although afterwards found to be susceptible when tested with virulent blood.

EXPERIMENT No. 132.

On March 5, 1913, Cyprus No. 2451 was inoculated subcutaneously with 5 c.c. meat emulsion made from Cattle Plague meat kept in the Cold Storage for three weeks. Isolated in the Commission stable No. 7.

No reaction.

On April 1, 1913, was tested with virulent blood.

On April 5, 1913, had a rise of temperature.

On April 8, 1913, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Negative. Did not contract the disease from the meat emulsion inoculation, although afterwards found to be susceptible when tested with virulent blood.

EXPERIMENT No. 155.

On April 7, 1913, Cyprus No. 2525 was inoculated subcutaneously with 5 c.c. meat emulsion made from meat kept in the Cold Storage for one week. Isolated in the Commission stable No. 3.

From April 14 to 18, 1913, had an irregular temperature.

From April 23 to 28, 1913, had an irregular temperature.

On April 26, 1913, was bled from vein to inoculate Cyprus No. 2601 from his blood.

On May 1, 1913, was tested with virulent blood.

On May 4, 1913, had a rise of temperature.

On May 7, 1913, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Negative. Did not contract the disease from the meat emulsion inoculation, although afterwards found to be susceptible when tested with virulent blood.

EXPERIMENT No. 161.

On April 14, 1913, Cyprus No. 2553 was inoculated subcutaneously with 5 c.c. meat emulsion made from Cattle Plague meat kept in the Cold Storage for two weeks. Isolated in the Commission stable No. 6.

No reaction.

Remark.—The animal had a very painful swelling at the site of inoculation. This swelling caused some fever for four days after inoculation.

On April 27, 1913, was tested with virulent blood.

On April 30, 1913, had a rise of temperature.

On May 3, 1913, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Negative. Did not contract the disease from the meat emulsion inoculation, although afterwards found to be susceptible when tested with virulent blood.

EXPERIMENT No. 165.

On April 22, 1913, Cyprus No. 2574 was inoculated subcutaneously with 5 c.c. meat emulsion made from Cattle Plague meat kept in the Cold Storage for three weeks. Isolated.

No reaction.

On May 4, 1913, was tested with virulent blood.

On May 7, 1913, had a rise of temperature.

On May 10, 1913, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Negative. Did not contract the disease from the meat emulsion inoculation, although afterwards found to be susceptible when tested with virulent blood.

EXPERIMENT No. 174.

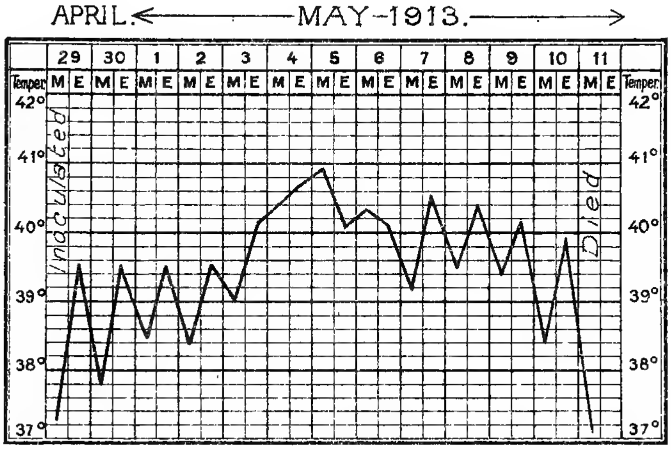
On April 29, 1913, Cyprus No. 2608 was inoculated subcutaneously with 5 c.c. meat emulsion made from Cattle Plague meat kept in the Cold Storage for four weeks. Isolated in the Commission stable No. 9.

On May 3, 1913, had a rise of temperature.
On May 11, 1913, died.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.

N.B.—In this experiment there was a possibility of accidental infection.



EXPERIMENT No. 180.

On May 5, 1913, Cyprus No. 2618 was inoculated subcutaneously with 5 c.c. meat emulsion made from Cattle Plague meat kept in the Cold Storage for five weeks. Isolated in the Commission stable No. 1.

No reaction.
On May 15, 1913, was tested with virulent blood.
On May 18, 1913, had a rise of temperature.
On May 21, 1913, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Negative. Did not contract the disease from the meat emulsion inoculation although afterwards found to be susceptible when tested with virulent blood.

EXPERIMENT No. 183.

On May 12, 1913, Cyprus No. 2634 was inoculated subcutaneously with 5 c.c. meat emulsion made from Cattle Plague meat kept in the Cold Storage for six weeks. Isolated in the Commission stable No. 4.

On May 18, 1913, had a rise of temperature.
On May 22, 1913, blood films were examined and Texas Fever parasites detected.
On May 29, 1913, was tested with virulent blood.
On May 31, 1913, had a rise of temperature.
On June 4, 1913, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Negative. Did not contract the disease from the meat emulsion inoculation, although alterwards found to be susceptible when tested with virulent blood.

EXPERIMENT NO. 189.

On May 19, 1913, Cyprus No. 2660 was inoculated subcutaneously with 5 c.c. meat emulsion made from Cattle Plague meat kept in the Cold Storage for seven weeks. Isolated in the Commission stable No. 9.

On May 24, 1913, had a rise of temperature which lasted three days, then the temperature was normal.

On June 2, 1913, was tested with virulent blood. Irregular temperature.

On June 8, 1913, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Negative. Did not contract the disease from the meat emulsion inoculation, although afterwards found to be susceptible when tested with virulent blood.

EXPERIMENT NO. 194.

On May 26, 1913, Cyprus No. 2683 was inoculated subcutaneously with 5 c.c. meat emulsion made from Cattle Plague meat kept in the Cold Storage for eight weeks. Isolated on the desert.

No reaction.

On June 6, 1913, was tested with virulent blood.

On June 9, 1913, had a rise of temperature.

On June 12, 1913, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Negative. Did not contract the disease from the meat emulsion inoculation, although afterwards found to be susceptible when tested with virulent blood.

EXPERIMENT NO. 195.

On June 2, 1913, Cyprus No. 2691 was inoculated subcutaneously with 5 c.c. meat emulsion made from Cattle Plague meat kept in the Cold Storage for nine weeks. Isolated in the Commission stable No. 7.

No reaction.

On June 13, 1913, was tested with virulent blood.

On June 15, 1913, had a rise of temperature.

On June 19, 1913, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Negative. Did not contract the disease from the meat emulsion inoculation, although afterwards found to be susceptible when tested with virulent blood.

TABLE No. 14.—Experiments to determine the Infectivity of the Flesh of Animals suffering from Cattle Plague.

EXPERIMENT No. 9.

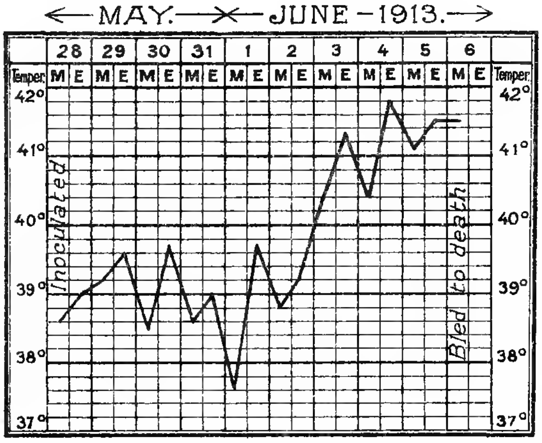
On May 28, 1912, Cyprus No. 5 was inoculated subcutaneously with 5 c.c. meat emulsion of Cattle Plague meat which had been kept at 13° C. for twenty-four hours. Isolated in the Commission stable No. 1.

On June 1, 1912, had a rise of temperature.

On June 6, 1912, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.



EXPERIMENT No. 15.

On June 12, 1912, Cyprus No. 11 was inoculated subcutaneously with 5 c.c. emulsion of Cattle Plague meat which had been kept at 13° C. for forty-eight hours. Isolated in the Commission stables.

On June 15, 1912, had a rise of temperature.

On June 17, 1912, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.

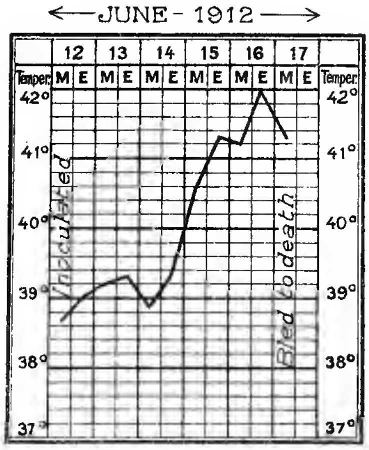


TABLE No. 15.—**Experiments to determine the Infectivity of the Flesh of Animals suffering from Cattle Plague.**

EXPERIMENT No. 10.

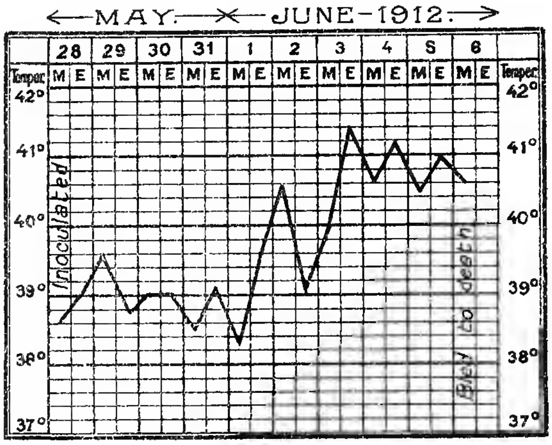
On May 28, 1912, Cyprus No. 10 was inoculated subcutaneously with 5 c.c. emulsion of Cattle Plague meat which had been kept at 28° C. for twenty-four hours. Isolated in the Commission stable No. 2.

On June 1, 1912, had a rise of temperature.

On June 6, 1912, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.



EXPERIMENT No. 16.

On June 12, 1912, Cyprus No. 12 was inoculated subcutaneously with 5 c.c. emulsion of Cattle Plague meat which had been kept at 28° C. for forty-eight hours. Isolated in the Commission stables.

On June 15, 1912, had a rise of temperature.

On June 17, 1912, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.

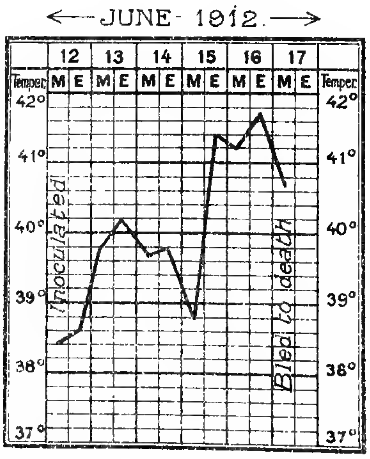


TABLE No. 16.—**Experiments to determine the Infectivity of Stomach Scrapings.**

The details of these experiments have been given in Table No. 16, page 18, of the report. There is nothing special to note in the individual experiments.

TABLE No. 17.—**Experiments to determine the Infectivity of Stomach Scrapings.**

EXPERIMENT No. 25.

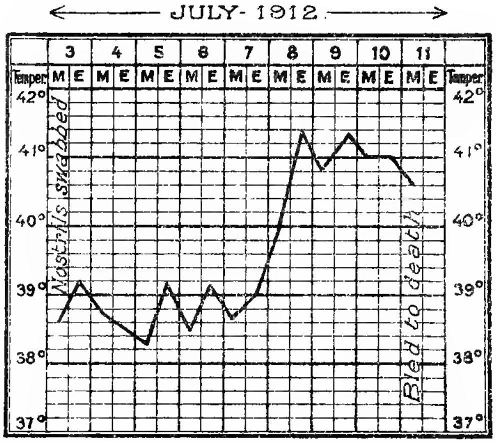
On July 3, 1912, Cyprus No. 1887 had his nostrils swabbed with fresh stomach scrapings from a Cattle Plague animal, No. 1867. Isolated in the Commission stables.

On July 8, 1912, had a rise of temperature.

On July 11, 1912, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.



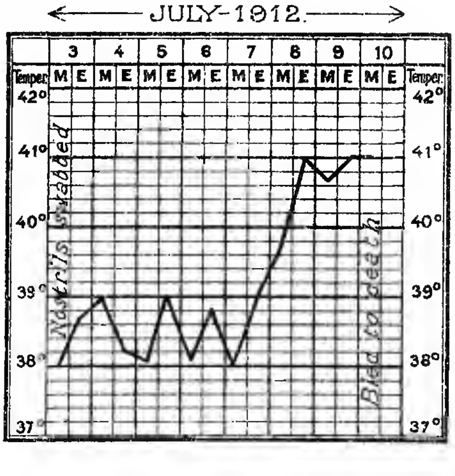
On July 3, 1912, Cyprus No. 1888 had his nostrils swabbed with fresh stomach scrapings from a Cattle Plague animal, No. 1867. Isolated in the Commission stables.

On July 8, 1912, had a rise of temperature.

On July 10, 1912, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.



EXPERIMENT No. 241.

On November 17, 1913, Cyprus No. 3146 had her vagina swabbed with stomach scrapings from a sixth day Cattle Plague animal. Isolated in the Commission stables.

On November 23, 1913, had a rise of temperature.

On November 26, 1913, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.

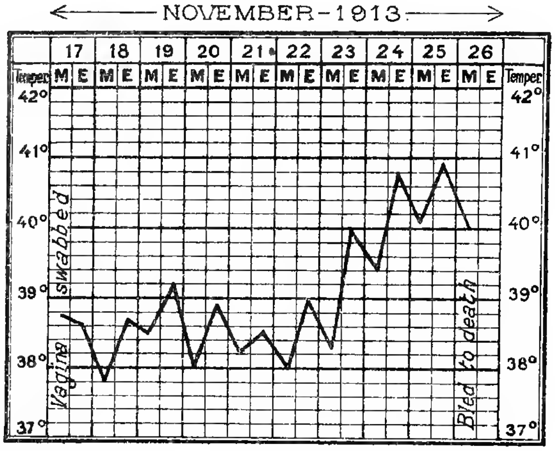


TABLE No. 18.—**Experiments to determine the Infectivity of the Liver of Cattle Plague Animals.**

EXPERIMENT No. 136.

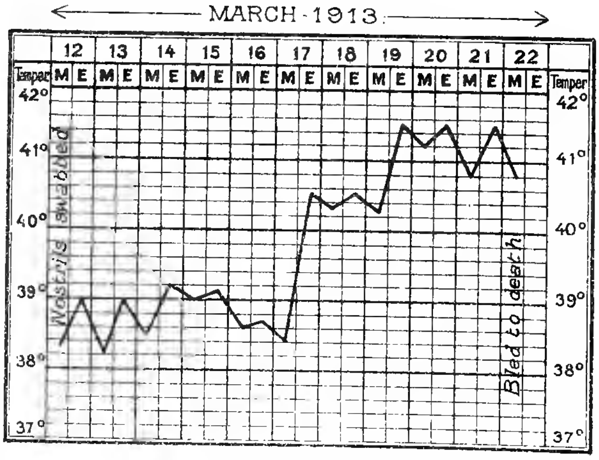
On March 12, 1913, Cyprus No. 2440 had his nostrils swabbed with two pieces of fresh liver from a Cattle Plague animal.

On March 17, 1913, had a rise of temperature.

On March 22, 1913, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.



Experiment No. 217.

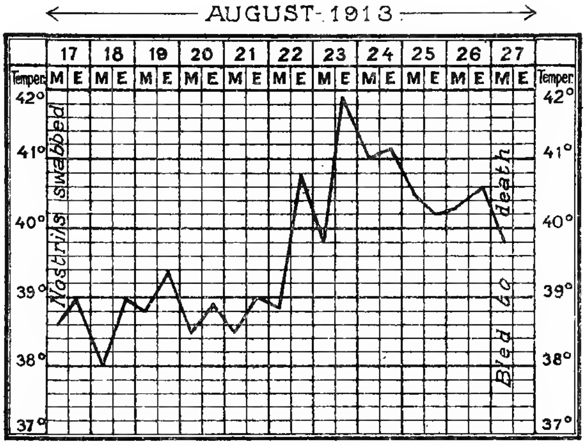
On August 17, 1913, Cyprus No. 2908 had his nostrils swabbed with scrapings from the liver of a Cattle Plague animal (sixth day). Isolated in the Commission stables.

On August 22, 1913, had a rise of temperature.

On August 27, 1913, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.



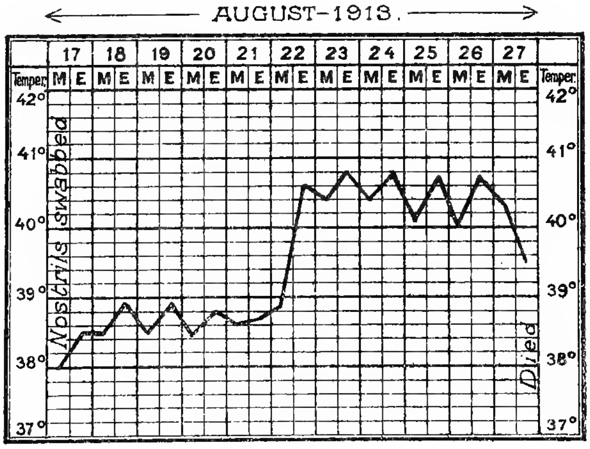
On August 17, 1913, Cyprus No. 2909 had his nostrils swabbed with scrapings from the liver of a Cattle Plague animal (sixth day). Isolated in the Commission stables.

On August 22, 1913, had a rise of temperature.

On August 27, 1913, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.



EXPERIMENT No. 227.

On September 10, 1913, Cyprus No. 3007 had her vagina swabbed with the scrapings of the liver of a Cattle Plague animal (sixth day). Isolated in the Commission stables.

On September 13, 1913, had a rise of temperature.

On September 21, 1913, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.

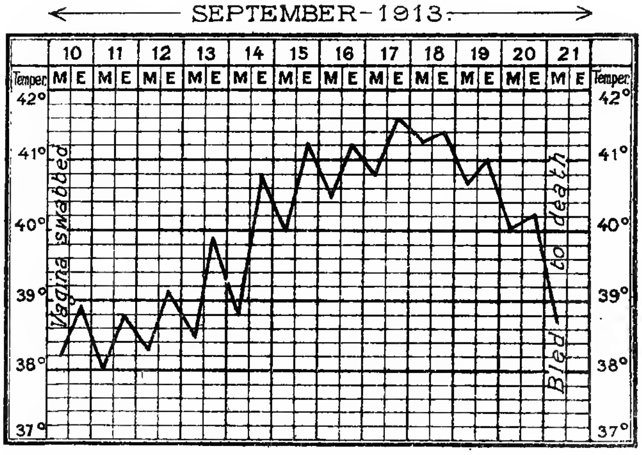


TABLE No. 19.—**Experiments to determine the Infectivity of the Spleen of Cattle Plague Animals.**

EXPERIMENT No. 142.

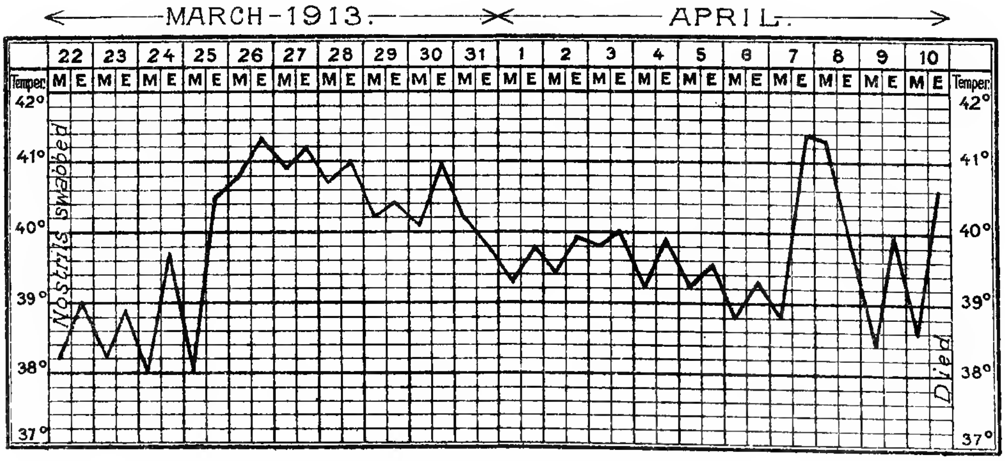
On March 22, 1913, Cyprus No. 2488 had his nostrils swabbed with two pieces of the spleen of a Cattle Plague animal (sixth day, after inoculation with virulent blood). Isolated in the Commission stable No. 1.

On March 25, 1913, had a rise of temperature.

On April 10, 1913, died.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.



EXPERIMENT No. 239.

On October 30, 1913, Cyprus No. 3066 had her vagina swabbed with emulsion from the spleen of a Cattle Plague animal (sixth day). Isolated in the Commission stable No. 8.

On November 3, 1913, had a rise of temperature.

On November 10, 1913, was bled to death for virulent blood, when moribund.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.

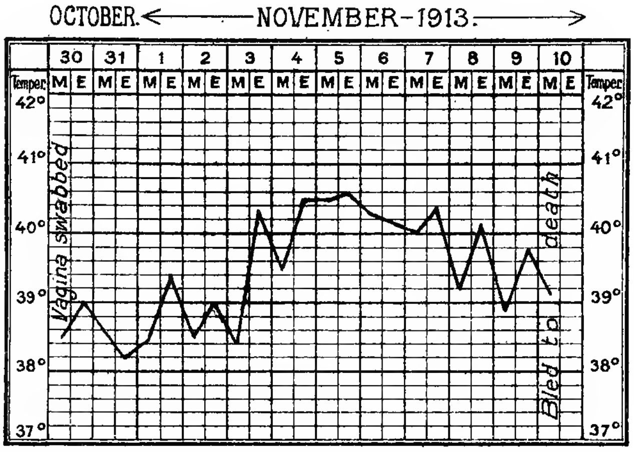


TABLE No. 20.—**Experiments to determine the Infectivity of Lymphatic Glands by Means of Mucous Surfaces.**

EXPERIMENT No. 221.

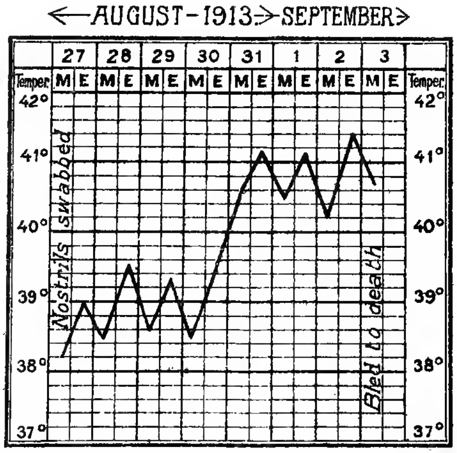
On August 27, 1913, Cyprus No. 2941 had his nostrils swabbed with the scrapings from the prescapular lymphatic gland of a Cattle Plague animal (sixth day). Isolated on the desert.

On August 30, 1913, had a rise of temperature.

On September 3, 1913, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.



EXPERIMENT No. 226.

On September 10, 1913, Cyprus No. 3001 had her vagina swabbed with scrapings from the prescapular lymphatic gland of a Cattle Plague animal (sixth day). Isolated in the Commission stable No. 9.

On September 14, 1913, had a rise of temperature.

On September 19, 1913, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.

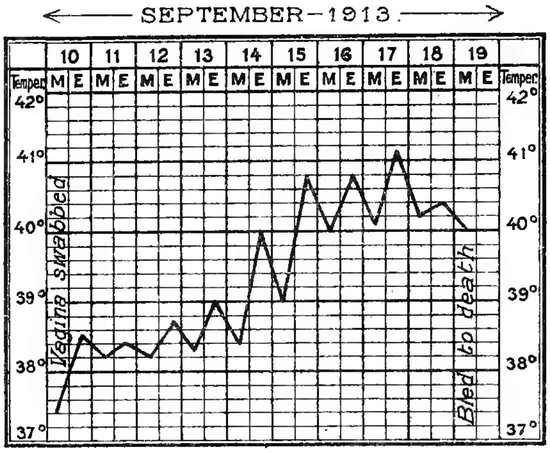


TABLE No. 21.—Experiments to determine the Infectivity of the Fresh Nasal Discharge of Cattle Plague Animals when applied to Mucous Surfaces.

EXPERIMENT No. 5.

On May 28, 1912, Cyprus No. 2 had his nostrils swabbed with nasal mucus from infected Cyprus No. 1833, and was placed amongst infected animals.

On June 3, 1912, films of his blood were examined for piroplasmata and found negative.

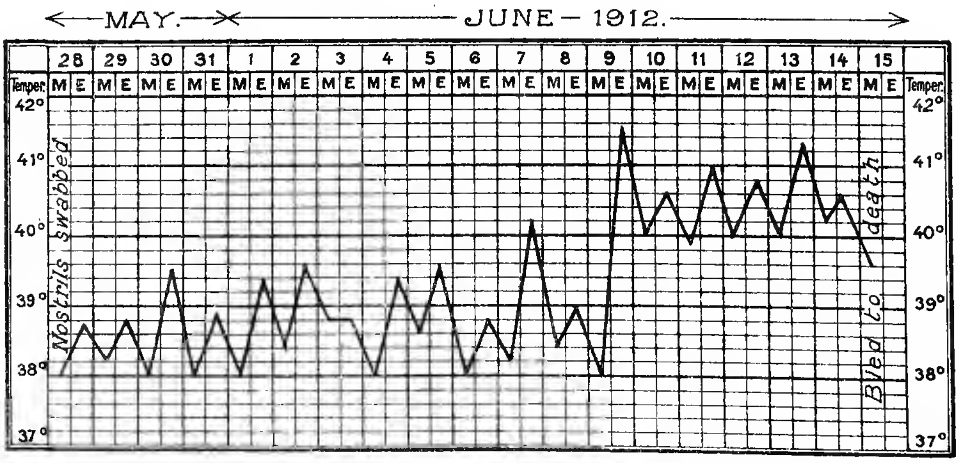
On June 9, 1912, had a rise of temperature.

On June 15, 1912, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Negative. Did not contract the disease from the swabbing of the nostrils, contracted the disease later through contact with infected animals.

N.B.—The nasal mucus used in this experiment was take from a Cattle Plague animal only four days after its inoculation with virulent blood, so that it would appear that at this period of the disease, the nasal mucus was not yet infective.



EXPERIMENT No. 5*a*.

On May 24, 1912, Cyprus No. 1833 was tested with virulent blood, had a typical Cattle Plague temperature.

On May 30, 1912, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

N.B.—Nasal mucus from this animal was used in the above experiment.

EXPERIMENT No. 19.

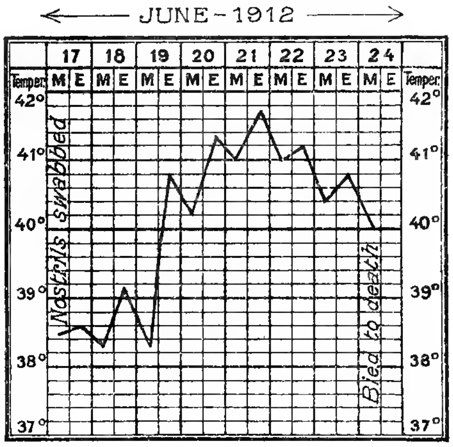
On June 17, 1912, Cyprus No. 23 had his nostrils swabbed with nasal mucus from a sixth day Cattle Plague animal, No. 1844. Isolated.

On June 19, 1912, had a rise of temperature.

On June 24, 1912, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.



EXPERIMENT No. 33*a*.

On July 7, 1912, Egyptian bull No. 179 had his nostrils smeared with nasal mucus from a Cattle Plague animal (sixth day).

No reaction.

On July 16, 1912, was tested with virulent blood and found to be immune.

Result.—Negative. Did not contract the disease but was subsequently found to be immune.

EXPERIMENT No. 35.

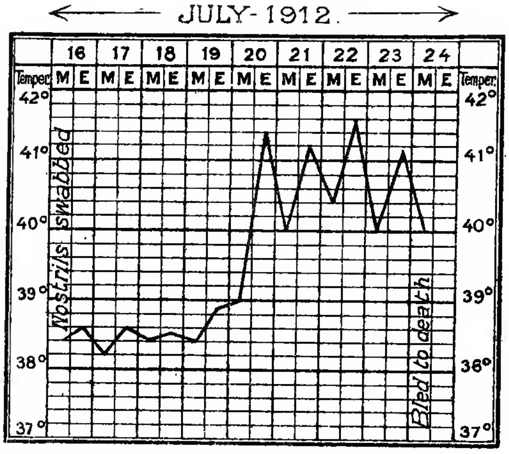
On July 16, 1912, Cyprus No. 1905 had his nostrils swabbed with nasal mucus from a sixth day Cattle Plague animal. Isolated in the Commission stables.

On July 20, 1912, had a rise of temperature.

On July 24, 1912, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.



EXPERIMENT A.

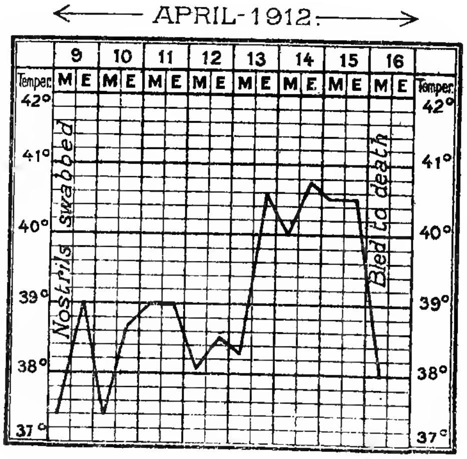
On April 9 and 10. 1912, Cyprus No. 1799 had his nostrils swabbed with nasal mucus from a sixth day Cattle Plague animal.

On April 13, 1912, had a rise of temperature.

On April 16, 1912, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.



EXPERIMENT B.

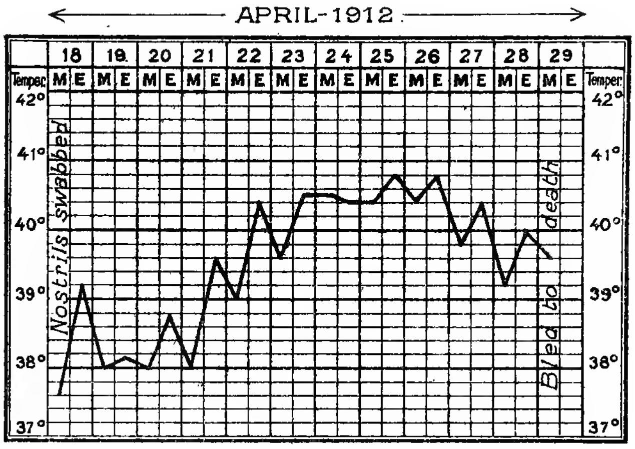
On April 18, 1912, Cyprus No. 1808 had his nostrils swabbed with nasal mucus from a sixth day Cattle Plague animal.

On April 21, 1912, had a rise of temperature.

On April 29, 1912, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.



EXPERIMENT C.

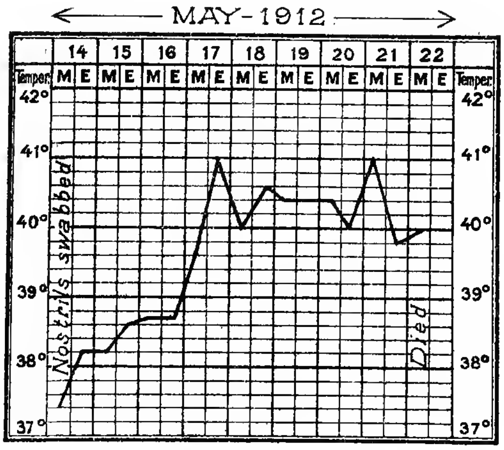
On May 14, 1912, Cyprus No. 1826 had his nostrils swabbed with nasal mucus from a sixth day Cattle Plague animal.

On May 17, 1912, had a rise of temperature.

On May 22, 1913, died.

Post-mortem —Cattle Plague.

Result.—Positive. Contracted the disease.



EXPERIMENT No. 28.

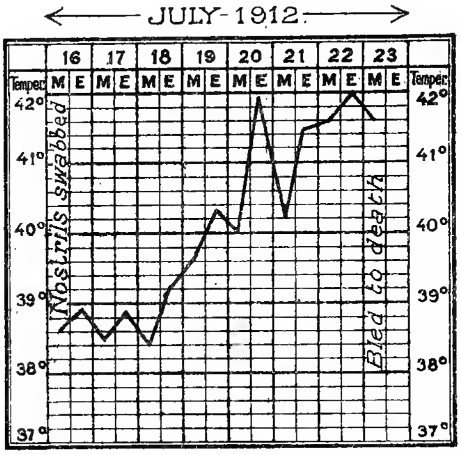
On July 16, 1912, Cyprus No. 1896 had his nostrils swabbed with nasal mucus from a sixth day Cattle Plague animal, No. 1891.

On July 19, 1912, had a rise of temperature.

On July 23, 1912, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.



EXPERIMENT No. 113.

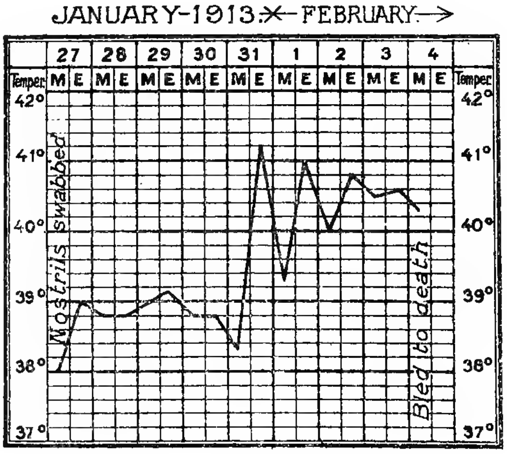
On January 27, 1913, Cyprus No. 2266 had his nostrils swabbed with the nasal mucus from a sixth day Cattle Plague animal and was isolated in sick lines.

On January 31, 1913, had a rise of temperature.

On February 4, 1913, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.



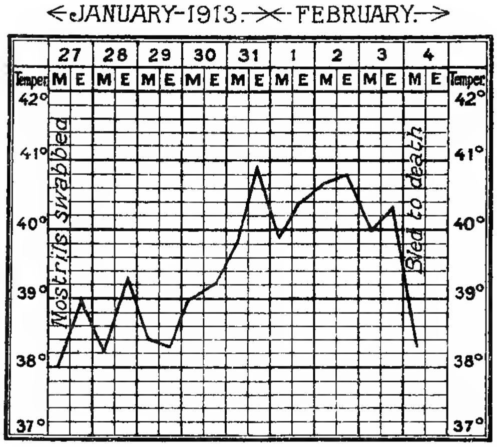
On January 27, 1913, Cyprus No. 2267 had his nostrils swabbed with the nasal mucus from a sixth day Cattle Plague animal and was isolated in sick lines.

On January 31, 1913, had a rise of temperature.

On February 4, 1913, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.



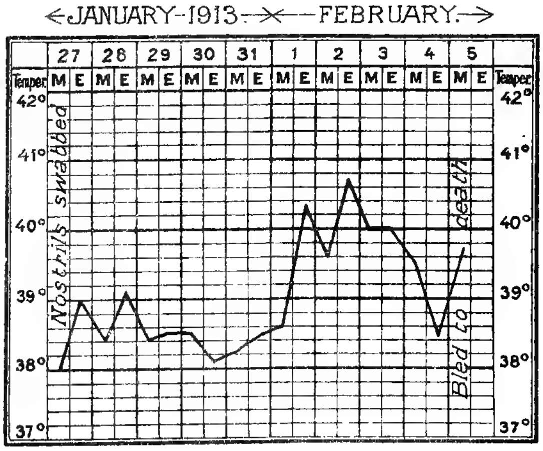
On January 27, 1913, Cyprus No. 2268 had his nostrils swabbed with the nasal mucus from a sixth day Cattle Plague animal and was isolated in sick lines.

On February 1, 1913, had a rise of temperature.

On February 5, 1913, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.



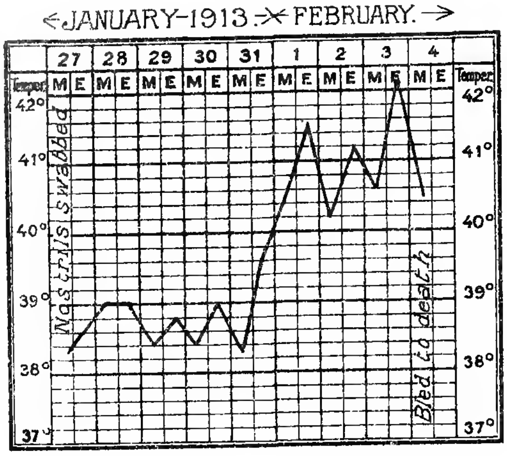
On January 27, 1913, Cyprus No. 2269 had his nostrils swabbed with the nasal mucus from a sixth day Cattle Plague animal and was isolated in sick lines.

On January 31, 1913, had a rise of temperature.

On February 4, 1913, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.

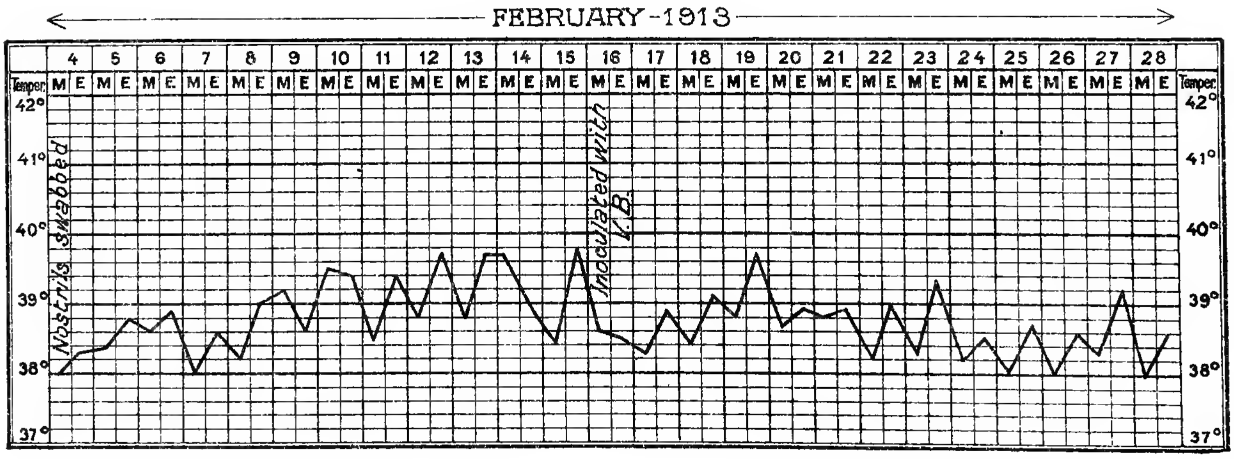


On February 4, 1913, Cyprus No. 2270 had his nostrils swabbed with the nasal mucus from an eighth day Cattle Plague animal and was isolated in sick lines.

On February 8, 1913, had a slight reaction.

On February 16, 1913, was tested with virulent blood and found to be immune.

Result.—Negative. Did not contract the disease but was subsequently found to be immune.



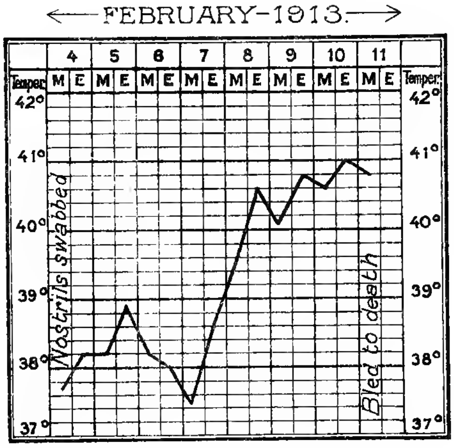
On February 4, 1913, Cyprus No. 2271 had his nostrils swabbed with the nasa mucus from an eighth day Cattle Plague animal and was isolated in sick lines.

On February 8, 1913, had a rise of temperature.

On February 11, 1913, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.



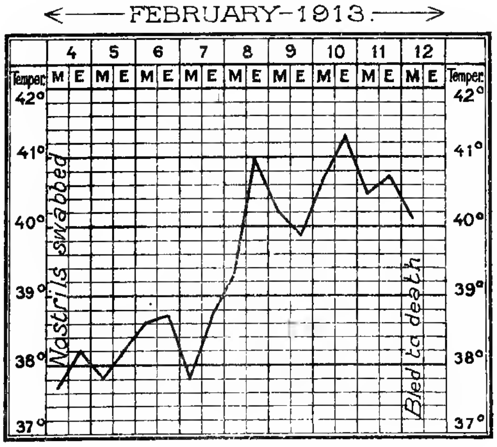
On February 4, 1913, Cyprus No. 2274 had his nostrils swabbed with the nasal mucus from an eighth day Cattle Plague animal and was isolated in sick lines.

On February 8, 1913, had a rise of temperature.

On February 12, 1912, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.



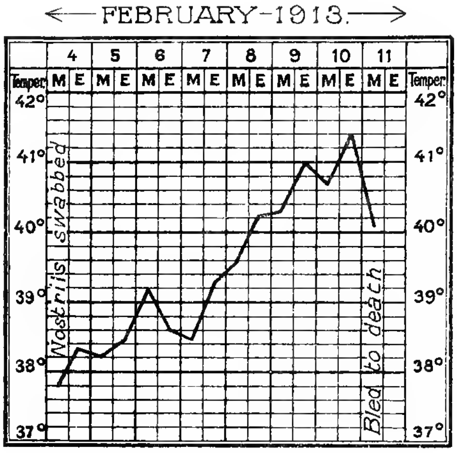
On February 4, 1913, Cyprus No. 2275 had his nostrils swabbed with the nasal mucus from an eighth day Cattle Plague animal and was isolated in sick lines.

On February 8, 1913, had a rise of temperature.

On February 11, 1913, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.



EXPERIMENT No. 140.

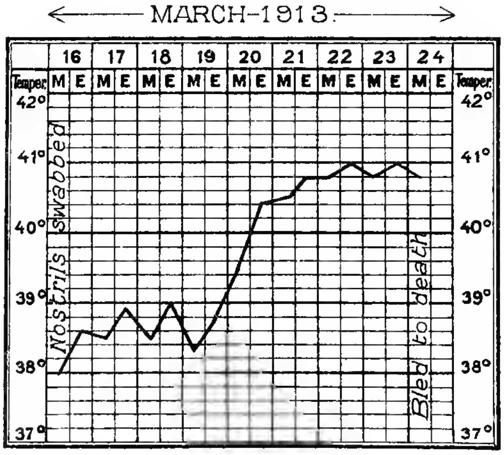
On March 16, 1913 Cyprus No. 2452 had his nostrils swabbed with the nasal mucus from an eighth day Cattle Plague animal and was isolated in the Commission stable No. 8.

On March 20, 1913, had a rise of temperature.

On March 24, 1913, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.



On March 16, 1913, Cyprus No. 2476, had his nostrils swabbed with the nasal mucus from an eighth day Cattle Plague animal and was isolated in the Commission stable No. 7.

No reaction.

On March 25, 1913, had his nostrils swabbed (more freely) with the nasal mucus from a sixth day Cattle Plague animal.

On March 29, 1913, had a rise of temperature.

On April 1, 1913, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Negative. Did not contract the disease from the first swabbing (nasal mucus eighth day), although afterwards found to be susceptible when swabbed more freely with a sixth day Cattle Plague nasal mucus.

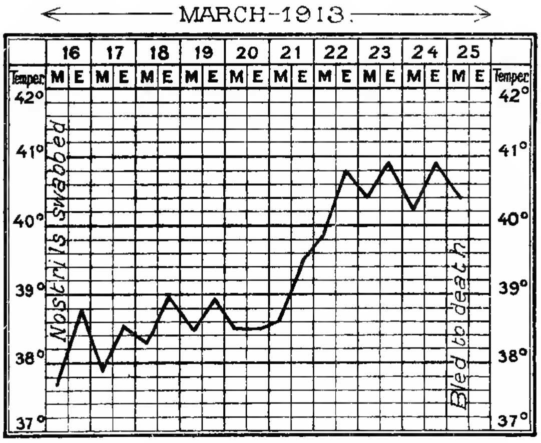
On March 16, 1913 Cyprus No. 2477 had his nostrils swabbed with the nasal mucus from an eighth day Cattle Plague animal and was isolated in the Commission stable No. 7.

On March 21, 1913, had a rise of temperature.

On March 25, 1913, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.



EXPERIMENT No. 169.

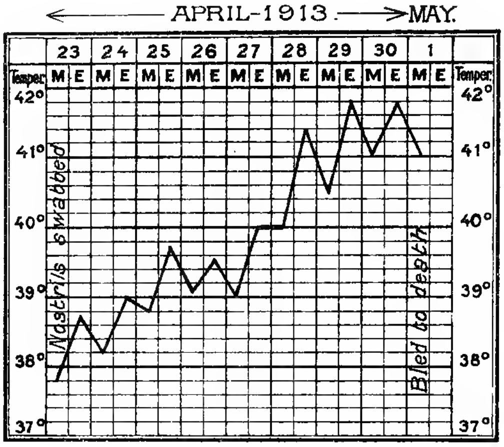
On April 23, 1913, Cyprus No. 2587 had his nostrils swabbed with the nasal mucus from a ninth day Cattle Plague animal, and was isolated in the Serum Institute isolation stables.

On April 27, 1913, had a rise of temperature.

On May 1, 1913, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.



EXPERIMENT No. 224.

On September 8, 1913, Cyprus No. 2969 had his nostrils swabbed with the nasal mucus from a fifth day Cattle Plague animal and was isolated in the Commission stable No. 1.

On September 12, 1913, had a rise of temperature.

On September 16, 1913, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.

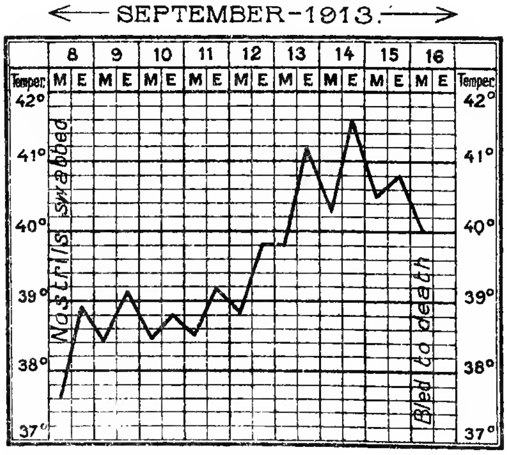


TABLE No. 22.—**Additional Experiments on the Infectivity of Nasal Mucus.**

EXPERIMENT No. 172.

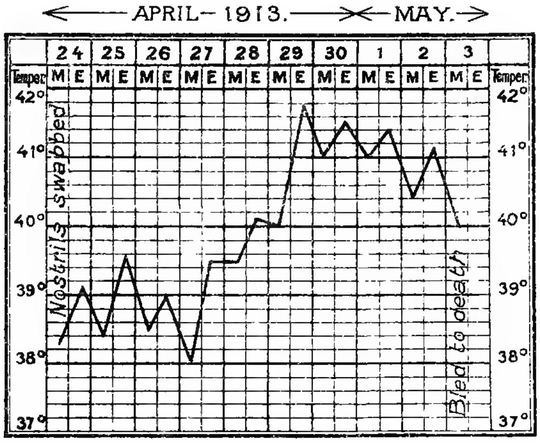
On April 24, 1913, Cyprus No. 2596 had his nostrils swabbed with nasal mucus from a ninth day Cattle Plague animal. The mucus had been collected on filter paper and kept in a moist chamber in the ice-safe for twenty-four hours.

On April 28, 1913, had a rise of temperature.

On May 3, 1913, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.



EXPERIMENT No. 173.

On April 25, 1913, Cyprus No. 2592 had his nostrils swabbed with nasal mucus from a ninth day Cattle Plague animal. The mucus had been collected on filter paper and kept in in a moist chamber in the ice-safe for forty-eight hours.

No reaction.

On May 3, 1913, was tested with virulent blood.

On May 6, 1913, had a rise of temperature.

On May 9, 1913, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Negative. Did not contract the disease from the swabbing with the nasal mucus forty-eight hours old, although afterwards found to be susceptible when tested with virulent blood.

Experiment No. 176.

On May 1, 1913, Cyprus No. 2612 had his nostrils swabbed with nasal mucus from a fifth day Cattle Plague animal. The mucus had been collected on filter paper and kept in a moist chamber in the ice-safe for forty-eight hours.

On May 5, 1913, had a rise of temperature.

On May 8, 1913, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.

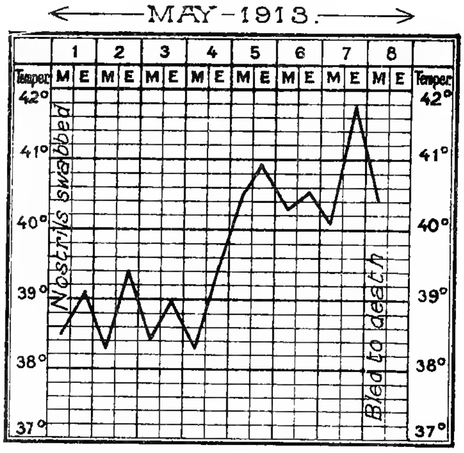


Table No. 23.—**Experiments to determine the Infectivity of the Nasal Discharge of Cattle Plague Animals when Inoculated Subcutaneously.**

Experiment No. 36.

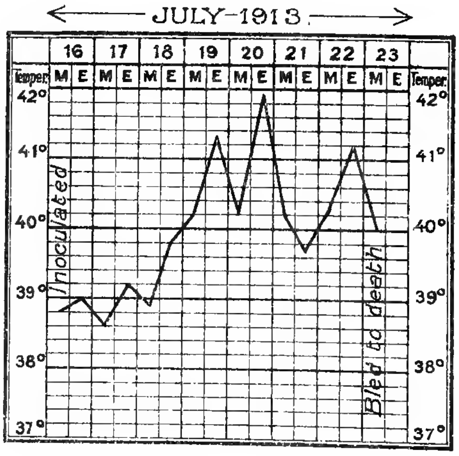
On July 16, 1912, Cyprus No. 1906 was inoculated subcutaneously with 15 c.c. of a suspension of Cattle Plague nasal mucus in saline solution and was isolated in Commission stables.

On July 18, 1912, had a rise of temperature.

On July 23, 1912, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.



On July 16, 1912, Cyprus No. 1907 was inoculated subcutaneously with 15 c.c. of a suspension of Cattle Plague nasal mucus in saline solution and was isolated in the Commission stables.

On July 19, 1912, had a rise of temperature.

On July 21, 1912, showed typical signs of Cattle Plague and was transferred to the infected stables.

On July 26, 1912, the temperature returned to normal, and the animal recovered.

Result.—Positive. Contracted the disease.

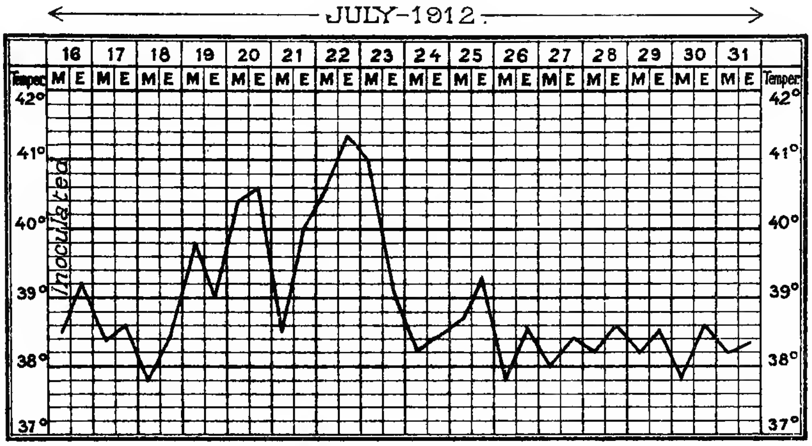


TABLE No. 24.—**Experiments to determine the Infectivity of the Nasal Discharge of Cattle Plague Animals when applied to Mucous Surfaces.**

EXPERIMENT No. 206.

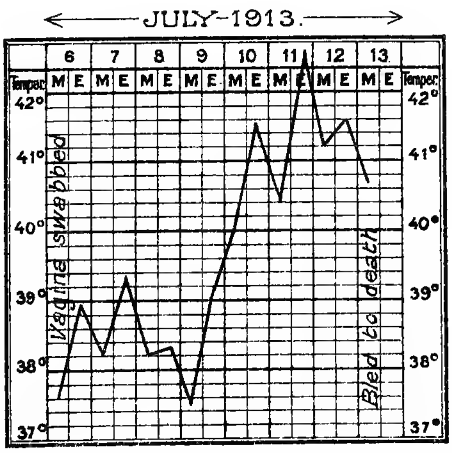
On July 6, 1913, Cyprus Cow No. 2819 had her vagina swabbed with fresh nasal mucus from a sixth day Cattle Plague animal and was isolated outside Commission stable No. 1.

On July 10, 1913, had a rise of temperature.

On July 13, 1913, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.



EXPERIMENT No. 222.

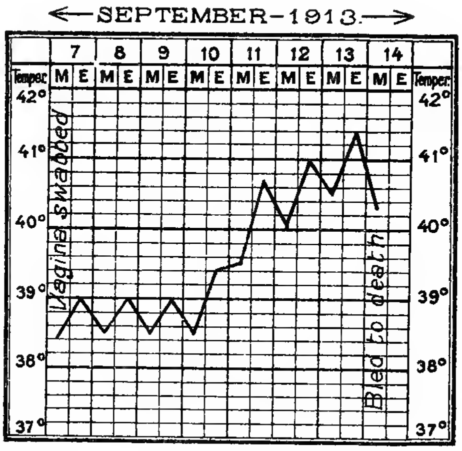
On September 7, 1913, Cyprus cow No. 2992 had her vagina swabbed with fresh nasal mucus from a fourth day Cattle Plague animal and was isolated in the Commission stable No. 8.

On September 10, 1913, had a rise of temperature.

On September 14, 1913, was bled to death for virulent blood.

Post mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.



EXPERIMENT No. 40.

On July 27, 1912, Cyprus No. 1930 had both eyes swabbed with fresh nasal mucus from an eighth day Cattle Plague animal, and was isolated in the Commission stables.

On August 1, 1912, had a rise of temperature.

On August 4, 1912, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.

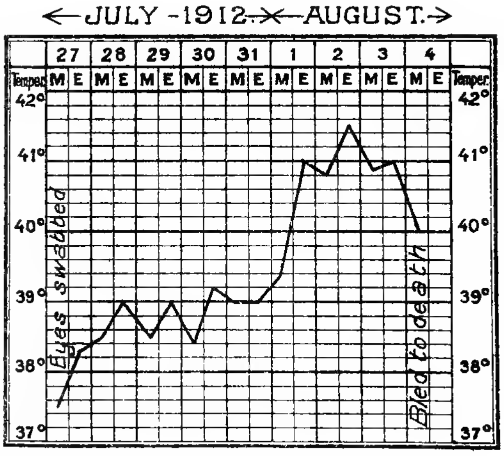


TABLE No. 25.—**Experiments with the Urine of Cattle Plague Animals.**

EXPERIMENT K.

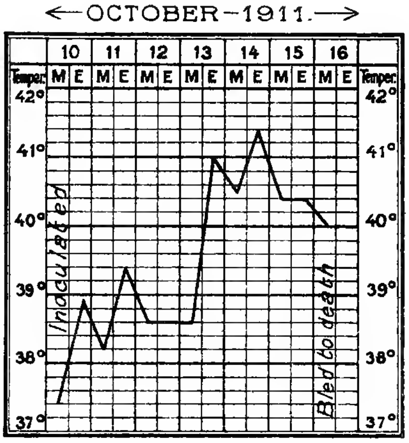
On October 10, 1911, Cyprus No. 1668 was inoculated subcutaneously with 4 c.c. of urine from a Cattle Plague animal four days after his inoculation with virulent blood (the second day of fever).

On October 13, 1911, had a rise of temperature.

On October 16, 1911, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.



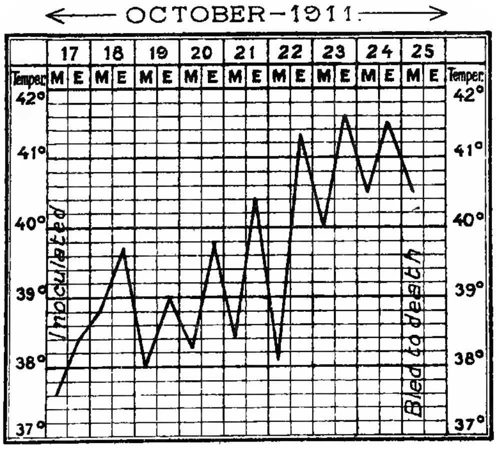
EXPERIMENT L.

On October 17, 1911, Cyprus No. 1672 was inoculated subcutaneously with 0·1 c.c. of urine from a Cattle Plague animal four days after his inoculation with virulent blood (first day of fever).

On October 20, 1911, had a rise of temperature.

On October 25, 1911, was bled to death for virulent blood.

Result.—Positive. Contracted the disease.



EXPERIMENT M.

On October 28, 1911, Cyprus No. 1680 was inoculated subcutaneously with 0·1 c.c. of urine from a Cattle Plague animal four days after his inoculation with virulent blood.

He remained normal and was afterwards tested with virulent blood and found to be susceptible.

Post-mortem.—Cattle Plague.

Result.—Negative. Did not contract the disease, although afterwards found to be susceptible when tested with virulent blood.

TABLE No. 26.—**Experiments with the Urine of Cattle Plague Animals.**

EXPERIMENT No. 145.

On March 25, 1913, Cyprus No. 2509 was inoculated subcutaneously with 2 c.c. of the sediment of centrifuged Cattle Plague urine, and was isolated in Commission stable No. 3.

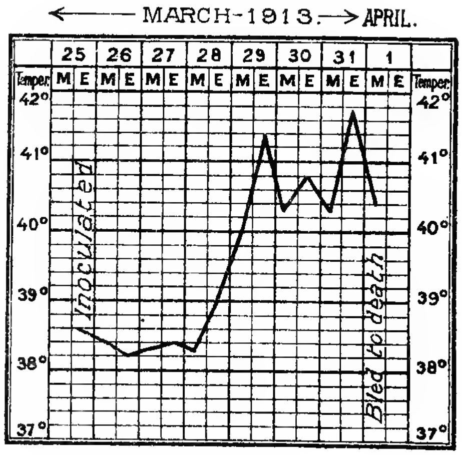
On March 29, 1913, had a rise of temperature.

On April 1, 1913, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.

N.B.—The urine was collected post-mortem from the bladders of three bulls, it was then centrifugalized and the deposit used for the inoculation.



EXPERIMENT No. 146.

On March 25, 1913, Cyprus No. 2510 had his nostrils swabbed with the sediment of centrifuged Cattle Plague urine and was isolated in the Commission stable No. 4.

On March 29, 1913, had a rise of temperature.

On April 2, 1913, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.

N.B.—The urine was collected post-mortem from the bladders of three bulls, it was then centrifugalized and the deposit used for the swabbing.

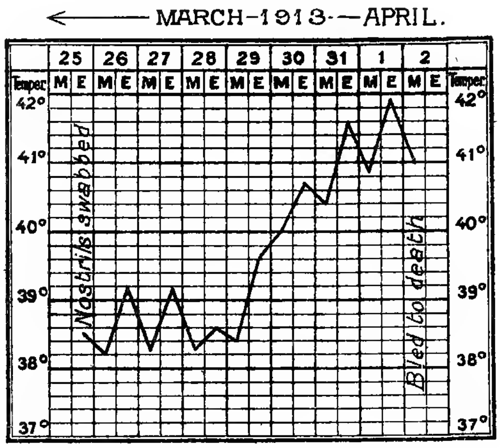


TABLE No. 27.—**Experiments to determine the Infectivity of Stables.**

EXPERIMENT No. 44.

This experiment was carried out in the infected stable in which the Cattle Plague animals used for the preparation of virulent blood for the routine work of the Serum Institute were kept.

On August 1, 1912, the infected animals were removed from the stable, but the stable was not cleaned and the infected forage, manure, etc., were left *in situ.*

On August 5, 1912, Cyprus No. 1934 was placed in the above stable where he remained for three days.

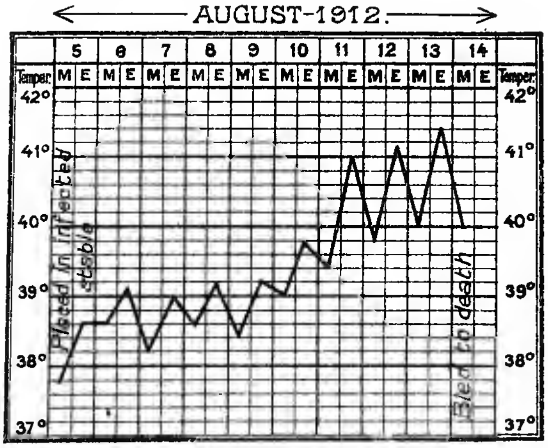
On August 7, 1912, he was isolated in the Commission stables.

On August 10, 1912, had a rise of temperature.

On August 14, 1912, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.



EXPERIMENT No. 50.

This experiment was carried out in the infected stable in which the Cattle Plague animals used for the preparation of virulent blood for the routine work of the Serum Institute were kept.

On August 1, 1912, infected animals removed from the stable, but the stable was not cleaned and the infected forage, manure, etc., were left *in situ.*

On August 11, 1912, Cyprus No. 1940 was placed in the above stable where he remained for three days.

On August 14, 1912, transferred to the Commission stables.

On August 22, 1912, had a rise of temperature.

On August 25, 1912, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Uncertain ; the animal contracted the disease, but as the first rise of temperature did not occur until eight and a half days after isolation, the possibility of subsequent accidental infection cannot be excluded.

EXPERIMENT No. 130.

On March 5, 1913, Cyprus No. 2428, which had been inoculated with virulent blood on February 27, 1913, and showed clinical symptoms of Cattle Plague, was put in Animal Isolation Hospital Box No. 5.

On March 8, 1913, this bull died in the stable ; the carcase was removed and the box containing the forage left by the dead bull and the manure was shut up and kept closed until March 10, 1913.

Instructions were given that nothing should be removed and that the door should not be opened.

On March 18, 1913, Cyprus No. 2481 was put in this box and fed on the forage left by the dead bull.

From March 18 to 30, 1913, he remained normal.

On March 30, 1913, was tested with virulent blood.

On April 2, 1913, had a typical rise of temperature.

On April 5, 1913, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Negative. Did not contract the disease, although afterwards found to be susceptible when tested with virulent blood.

EXPERIMENT No. 139.

On March 5, 1913, Cyprus No. 2450 was placed in Commission stable No. 9 and infected with Cattle Plague.

On March 10, 1913, had a temperature of 41° C.

On March 11, 1913, *i.e.* after the fever had lasted for thirty hours, he was removed from the stable. The stable was not cleaned the forage and manure being left—but was left closed for twenty-four hours.

On March 12, 1913, Cyprus No. 2471 was placed in the stable, where he remained for eleven days.

On March 23, 1913, this animal which had remained well was tested with virulent blood, had a typical Cattle Plague chart, and was bled to death for virulent blood on March 30, 1913.

Post-mortem.—Cattle Plague.

Result.—Negative. Did not contract the disease, although afterwards found to be susceptible when tested with virulent blood.

EXPERIMENT No. 141.

On March 19, 1913, Cyprus No. 2486 was placed in Commission stable No. 5, immediately after the removal of an animal sick of Cattle Plague. The latter having remained in the stable for fotry-eight hours after the first rise of temperature.

After the removal of the sick animal, the stable was swept, and the manger and water bucket emptied, but no further attempt was made to clean the stable.

Cyprus No. 2486 remained well until March 30, 1913, when he was tested with virulent blood, had a typical Cattle Plague chart, and was bled to death for virulent blood on April 5, 1913.

Post-mortem.—Cattle Plague.

Result.—Negative. Did not contract the disease, although afterwards found to be susceptible when tested with virulent blood.

EXPERIMENT No. 163.

On April 20, 1913, Cyprus No. 2570 was put in Box No. 5 of the Animal Isolation Hospital.

On April 11, 1913 (*i.e.* nine days previously) an animal sick of Cattle Plague had died in this box.

The box was bedded with a layer of sand about ten centimetres deep which was soaked with the urine and manure of the sick bull. After the removal of the carcase of the dead animal the stable was locked, leaving the forage, manure, etc., *in situ.*

Cyprus No. 2570 remained well until April 30, 1913, when he was tested with virulent blood, had a typical Cattle Plague chart, and was bled to death for virulent blood on May 6, 1913.

Post-mortem.—Cattle Plague.

Result.—Negative. Did not contract the disease, although afterwards found to be susceptible when tested with virulent blood.

EXPERIMENT No. 192.

On May 22, 1913, Cyprus Nos. 2667 and 2668 were placed in an infected stable, which had been closed for seven days after the removal of an animal which had been allowed to die of Cattle Plague in the stable, the forage, manure, etc., of the sick animal being left in the stable.

Both these animals remained for a month in the stable. They were tested with virulent blood, both had typical Cattle Plague charts, and were bled to death for virulent blood.

Post-mortem.—Cattle Plague in both cases.

Result.—Negative. Neither animal contracted the disease, although both were found to be susceptible on testing with virulent blood.

TABLE No. 28.—**Experiments to determine the Infectivity of the Hides of Cattle Plague Animals.**

When not otherwise stated, these experiments were made with the hides of animals which had been bled to death on the seventh day after inoculation with virulent blood; but in some cases the animals were allowed to die in order to simulate more closely the natural conditions; these cases are specially noted.

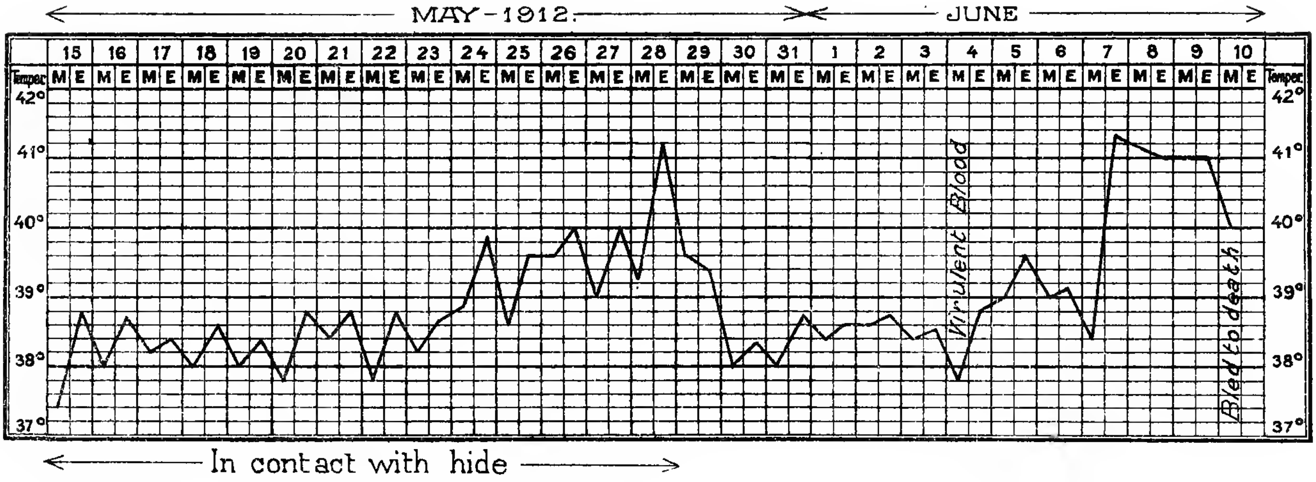
The hides were tested when quite freshly removed from the animal, also after keeping for different periods under various conditions.

The method of carrying out these experiments was as follows: the hide was spread on the floor of the stable and a susceptible Cyprus bull was so tethered that he came intimately into contact with the hide, sleeping on it and having his food off it.

EXPERIMENT No. 3.

Hide, rolled up fresh and kept in the shade for forty-eight hours. Cyprus bull No. 1828 kept in contact with hide as above described for thirteen days.

Result.—Animal remained well and was afterwards tested with virulent blood and found to be susceptible.

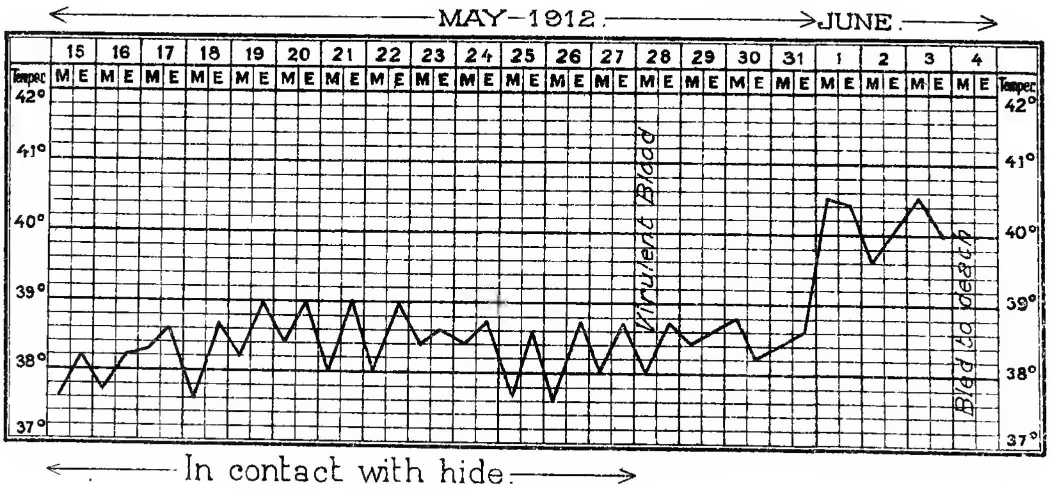


EXPERIMENT No. 4.

Hide, dried in the sun for forty-eight hours.

Cyprus bull No. 1829 kept in contact with hide for thirteen days.

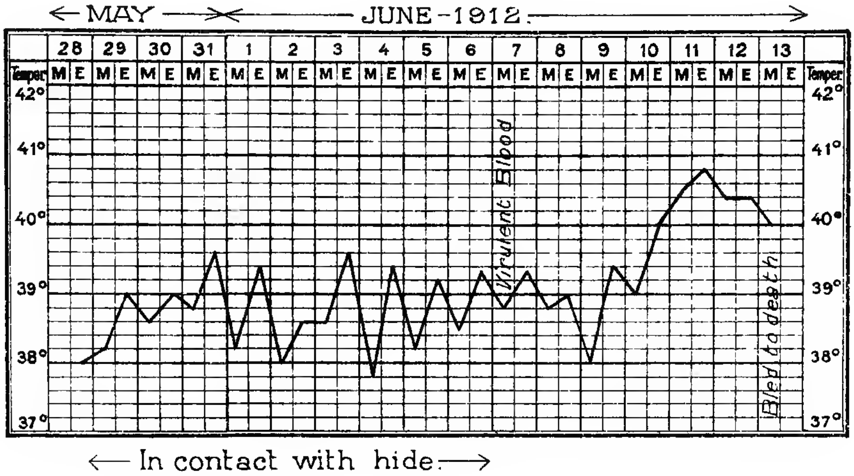
Result.—Animal remained well and was afterwards tested with virulent blood and found to be susceptible.



EXPERIMENT No. 7.

Hide, salted and spread out in shade for twenty-four hours.
Cyprus bull No. 2 kept in contact with hide for nine days.

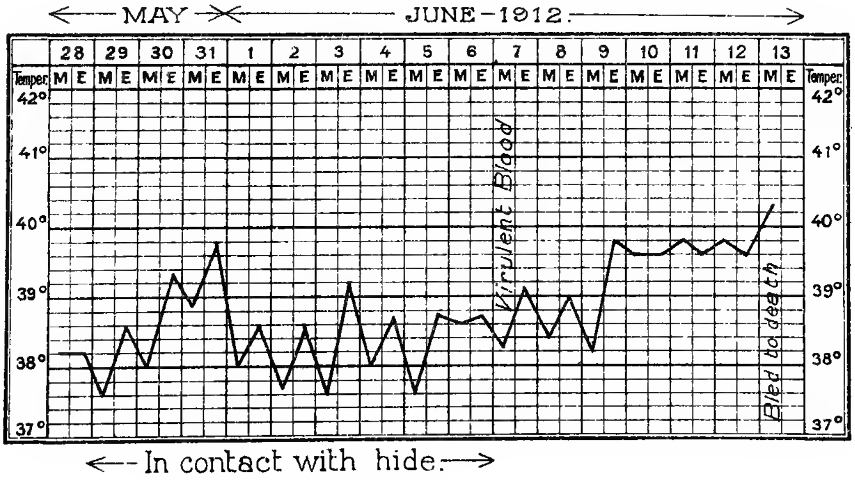
Result.—Animal remained well and was afterwards tested with virulent blood and found to be susceptible.



EXPERIMENT No. 8.

Hide, fresh, spread in shade for twenty-four hours.
Cyprus bull No. 4 kept in contact with hide for nine days.

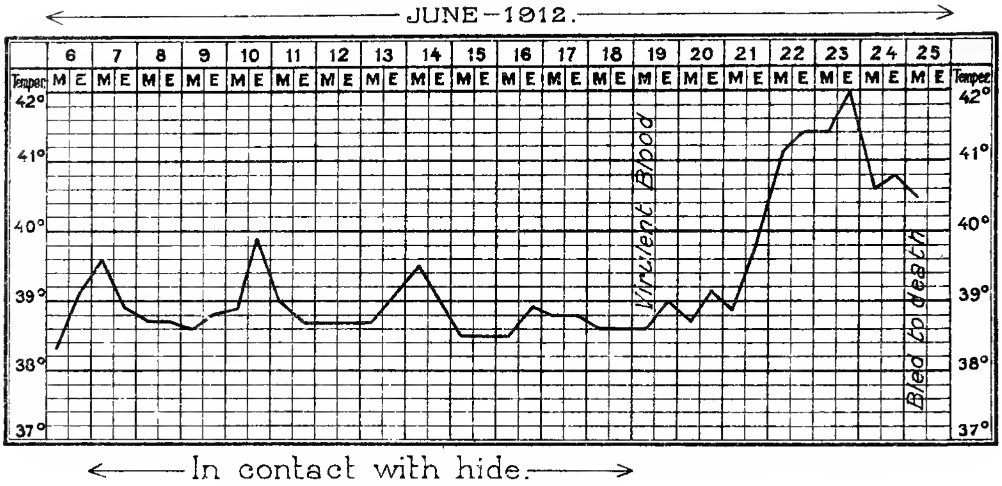
Result.—Animal remained well and was afterwards tested with virulent blood and found to be susceptible.



EXPERIMENT No. 12.

Hide, salted, folded, and put in the shade for nine and a half hours.
Cyprus bull No. 9 kept in contact with hide for twelve days.

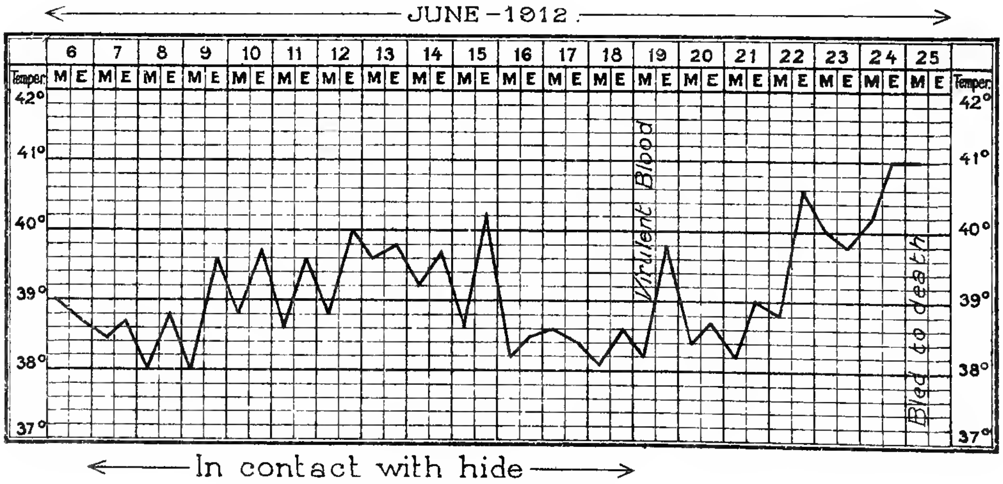
Result.—Animal remained well and was afterwards tested with virulent blood and found to be susceptible.



EXPERIMENT No. 13.

Hide, fresh, folded up and put in the shade for nine and half hours.
Cyprus bull No. $1838\frac{1}{1}$ kept in contact with hide for twelve days.

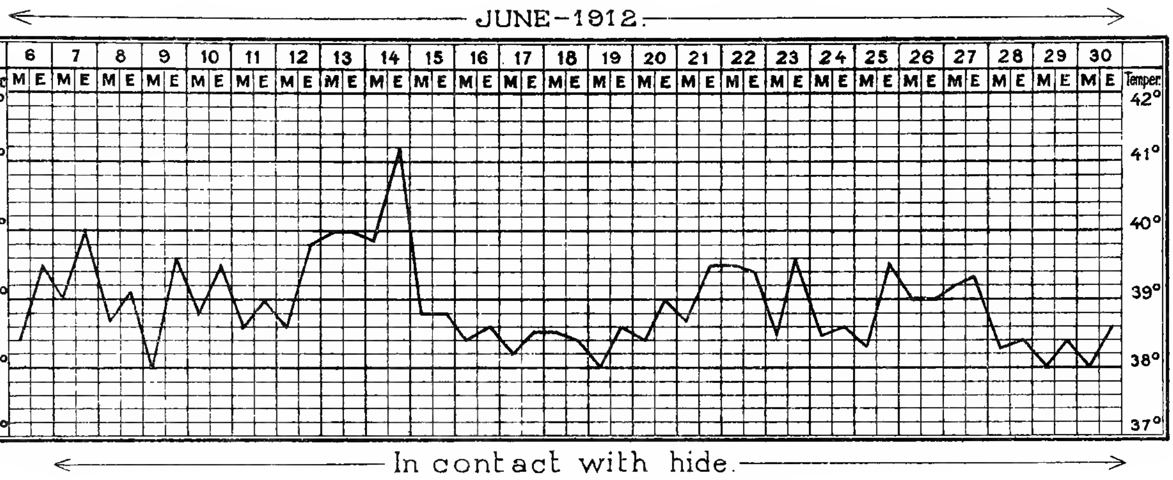
Result.—Animal remained well and was afterwards tested with virulent blood and found to be susceptible.

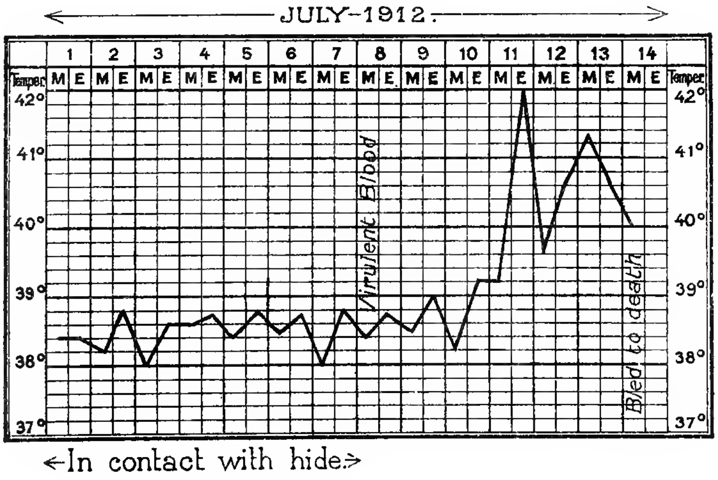


EXPERIMENT No. 14.

Hide, fresh, stretched on wooden frame and kept in the shade for nine and a half hours. Cyprus bull No. $1839\frac{2}{2}$ kept in contact with hide for thirty-one days.

Result.—Animal remained well and was afterwards tested with virulent blood and found to be susceptible.



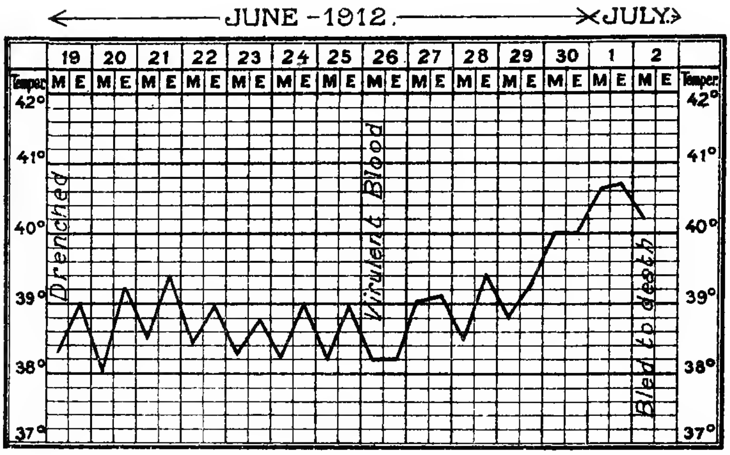


EXPERIMENT NO. 18.

Hide, fresh, folded up and put in the shade for forty-eight hours. It was then placed in a basin of water for one hour.

Cyprus bull No. 25 was drenched with one litre of above water.

Result.—Animal remained well and was afterwards tested with virulent blood and found to be susceptible.

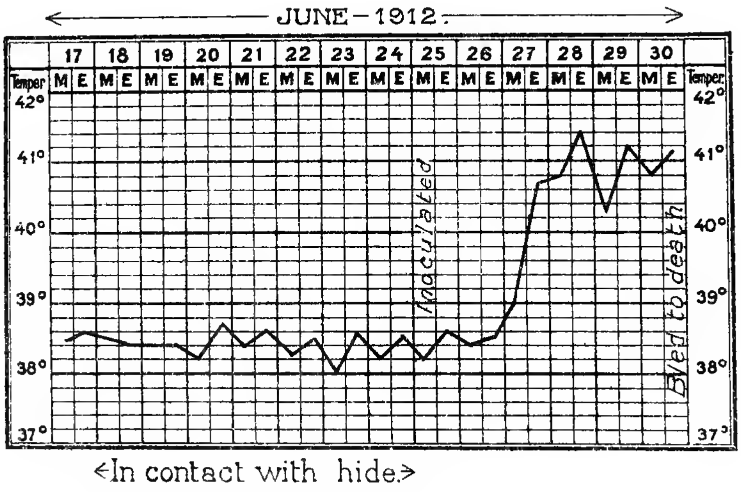


EXPERIMENT NO. 20.

Hide, sprinkled with one kilogramme of common salt immediately after skinning.

Cyprus bull No. 22 kept in contact with hide for seven days.

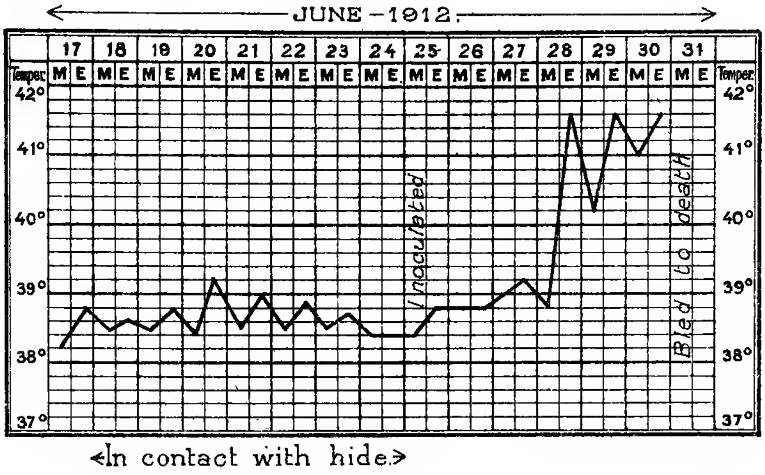
Result.—Animal remained well and was afterwards tested by inoculation subcutaneously with 5 c.c. of an emulsion of fresh Cattle Plague stomach scrapings and found to be susceptible.



EXPERIMENT No. 21.

Hide, fresh, taken immediately after skinning. Cyprus bull No. 24 kept in contact with hide for seven days.

Result.—Animal remained well and was afterwards tested by inoculation subcutaneously with 5 c.c. of an emulsion of fresh Cattle Plague stomach scrapings and found to be susceptible.



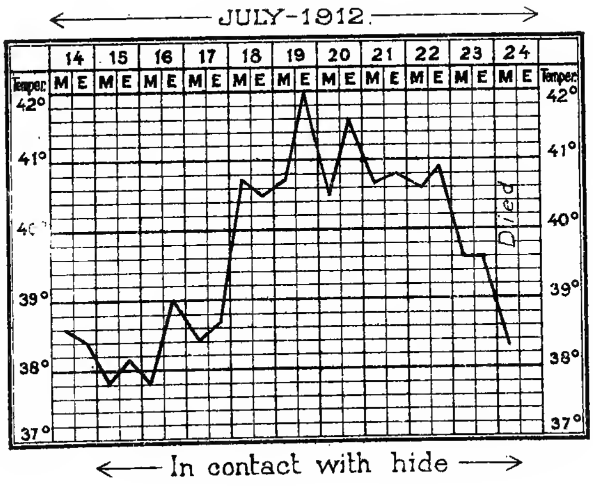
EXPERIMENT No. 34.

Hide, fresh, taken immediately after skinning. In this case the hide was taken from an animal which had died of Cattle Plague.

Cyprus bull No. 1903 kept in contact with hide as above described.

Result.—Animal went off food on second day and was clinically showing signs of illness. The temperature rose on the fourth day, and he died on the tenth day.

Post-mortem.—Cattle Plague.

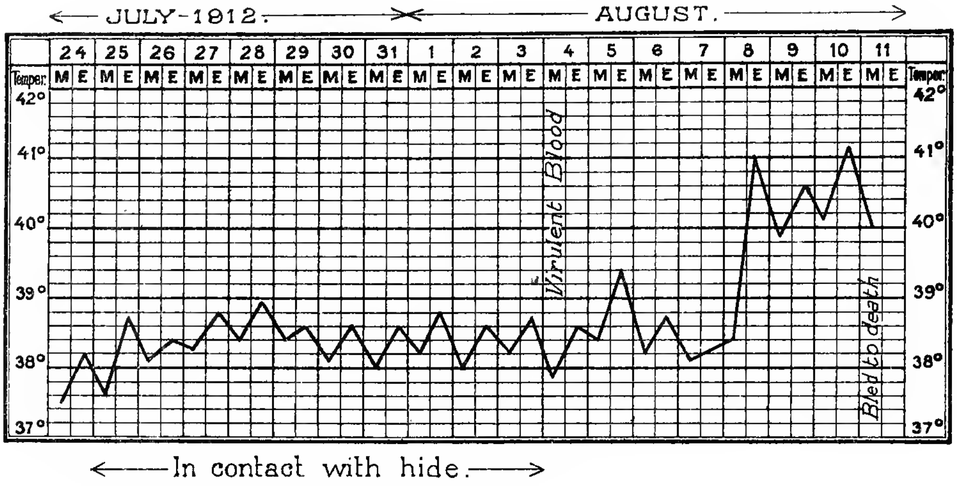


EXPERIMENT No. 38.

Hide, fresh, taken immediately after skinning from the bull (Cyprus No. 1903) of the former experiment, which had died of Cattle Plague.

Cyprus bull No. 1926 kept in contact with hide for ten days.

Result.—Animal remained well and was afterwards tested with virulent blood and found to be susceptible.



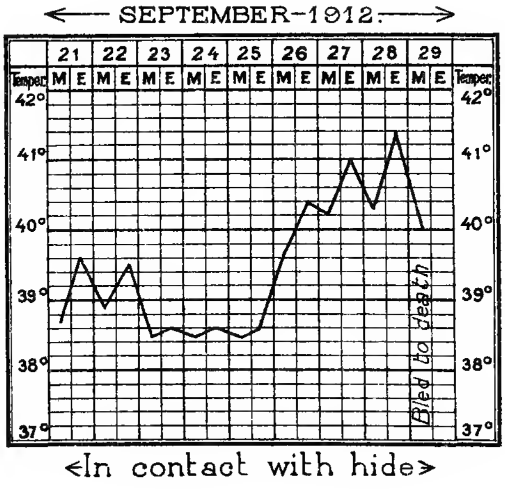
EXPERIMENT No. 75.

Hide, fresh, taken immediately after skinning from a Cyprus bull which had died of Cattle Plague.

Cyprus bull No. 2034 kept in contact with hide.

Result.—Animal had a rise of temperature on the fifth morning and showed clinical signs of Cattle Plague. He was bled to death on the eighth day.

Post-mortem.—Cattle Plague.

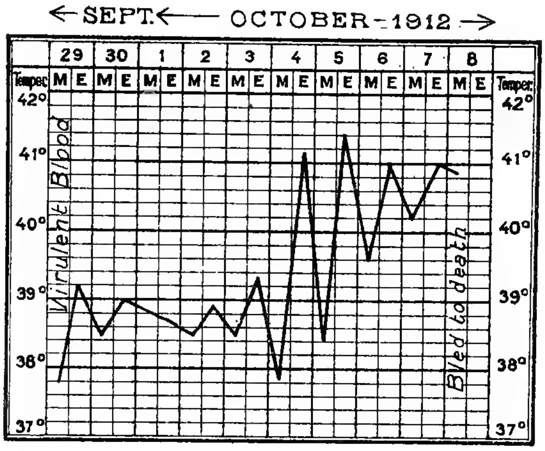


EXPERIMENT No. 75*a* (*control*).

Cyprus bull No. 2049 inoculated with 2 c.c. of the blood of Cyprus No. 2054 (*see* above experiment).

Result.—Animal had rise of temperature on the fifth evening and he was bled to death on the ninth morning after inoculation.

Post-mortem.—Cattle Plague.

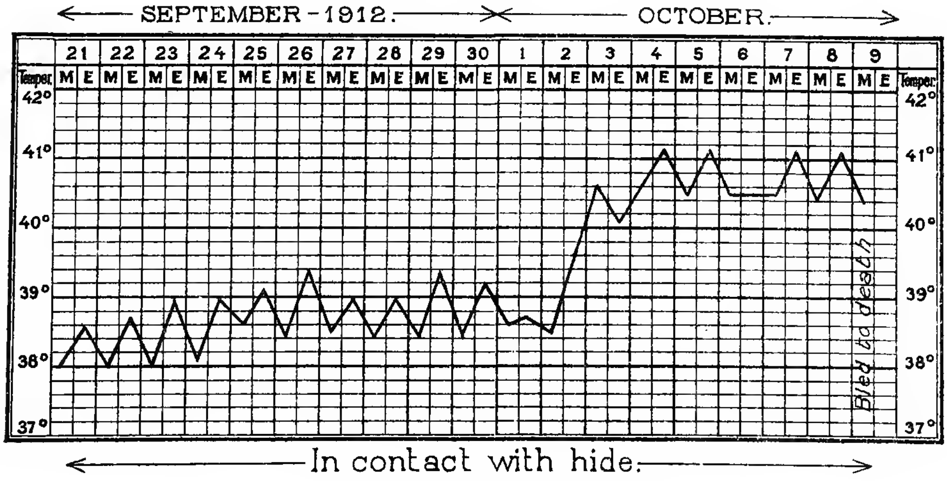


EXPERIMENT No. 76.

Hide, folded up and put in the shade for twenty-four hours.
Cyprus bull No. 2035 kept in contact with hide.

Result.—Animal had a rise of temperature on the twelfth morning and showed clinical signs of Cattle Plague. He was bled to death on the eighteenth day.

Post-mortem.—Cattle Plague.

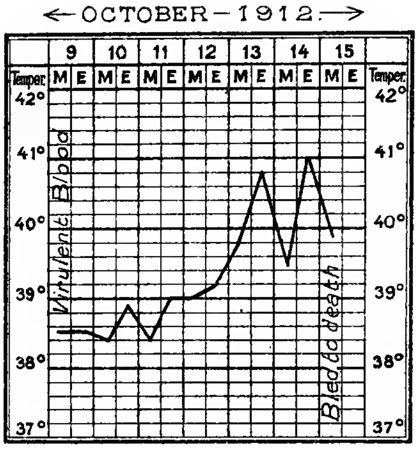


EXPERIMENT No. 76*a* (*control*).

Cyprus bull No. 2026 inoculated with 2 c.c. of the blood of Cyprus No. 2035 (*see* above experiment).

Result.—Animal had a rise of temperature on the fourth morning and was bled to death on the sixth morning after inoculation.

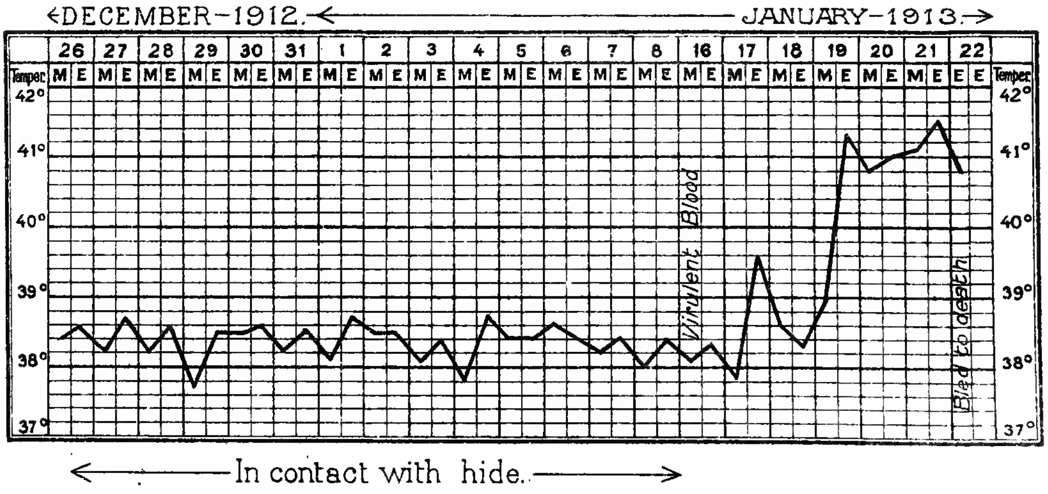
Post-mortem.—Cattle Plague.



EXPERIMENT No. 105.

Hide, fresh, taken immediately after skinning
Cyprus bull No. 2301 kept in contact with hide for thirty-one days.

Result.—Animal remained well and was afterwards tested with virulent blood and found to be susceptible.

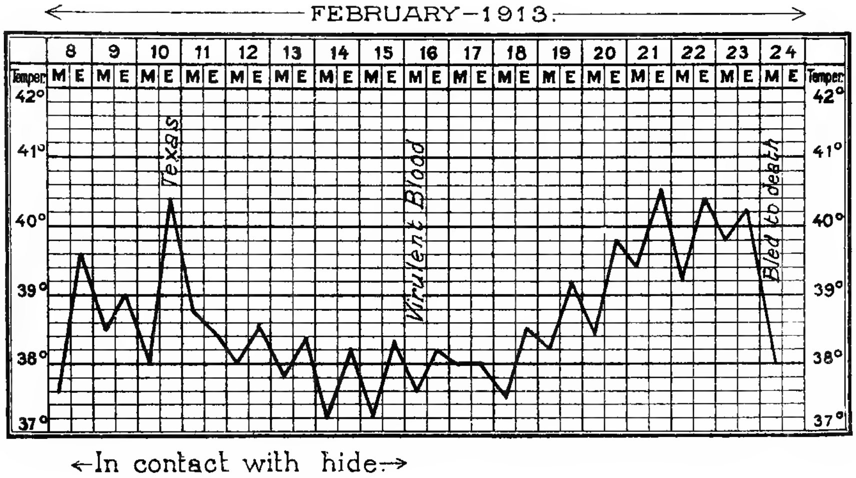


EXPERIMENT No. 119.

Hide, fresh, taken immediately after skinning.

Cyprus bull No. 2311 kept in contact with hide for seven days.

Result.—There was a rise of temperature on the second evening when Texas Fever parasites were found in the blood. Otherwise the animal remained well and was afterwards tested with virulent blood and found to be susceptible.

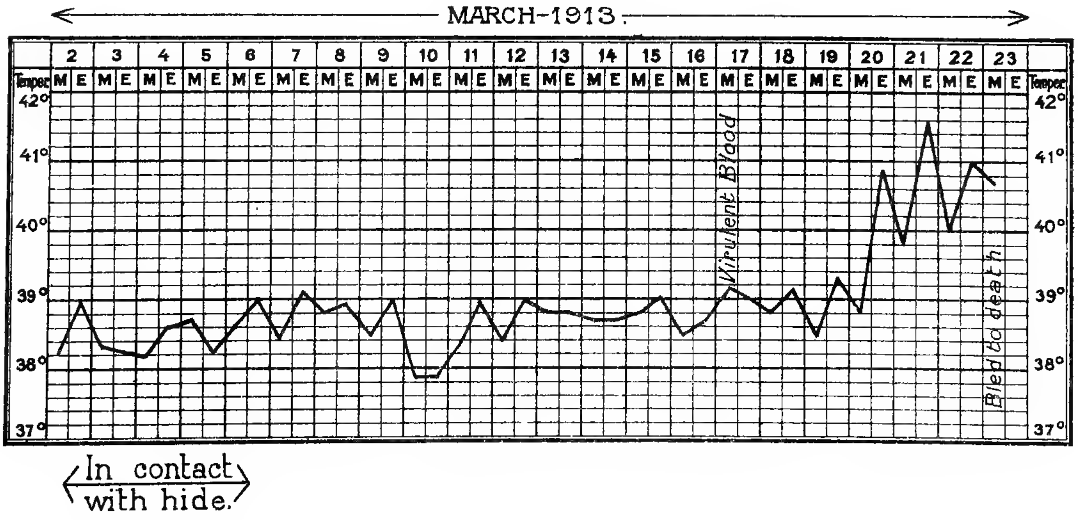


EXPERIMENT No. 126.

Hide, outer side smeared with manure and mucus from a bull suffering from Cattle Plague.

Cyprus bull No. 2435 kept in contact with hide for four days.

Result.—Animal remained well and was afterwards tested with virulent blood and found to be susceptible.

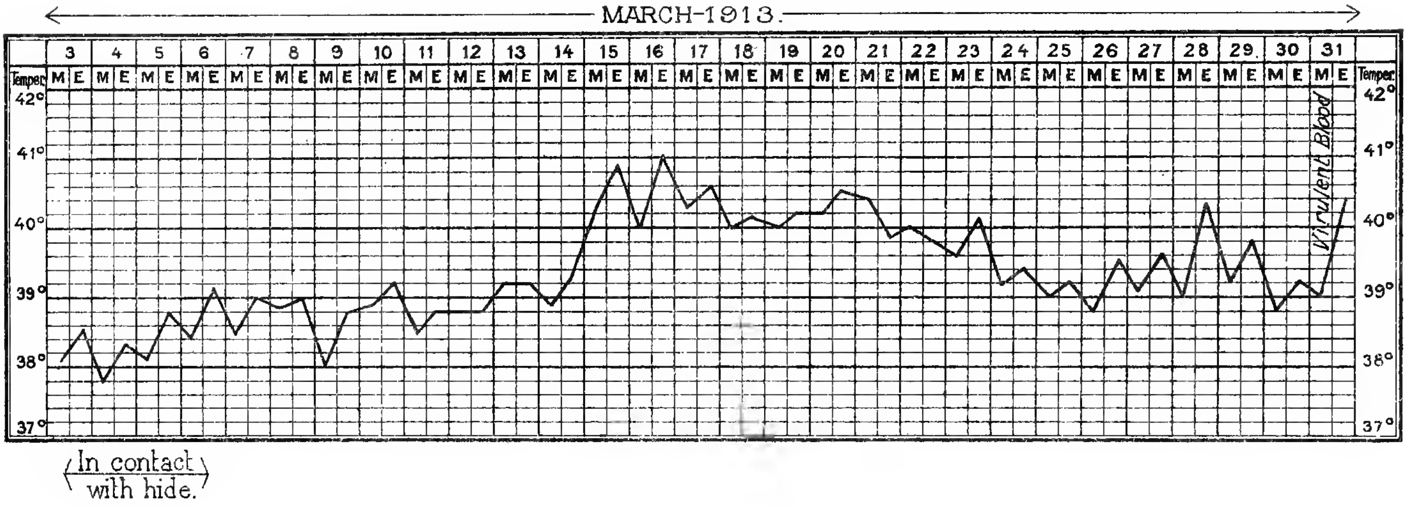


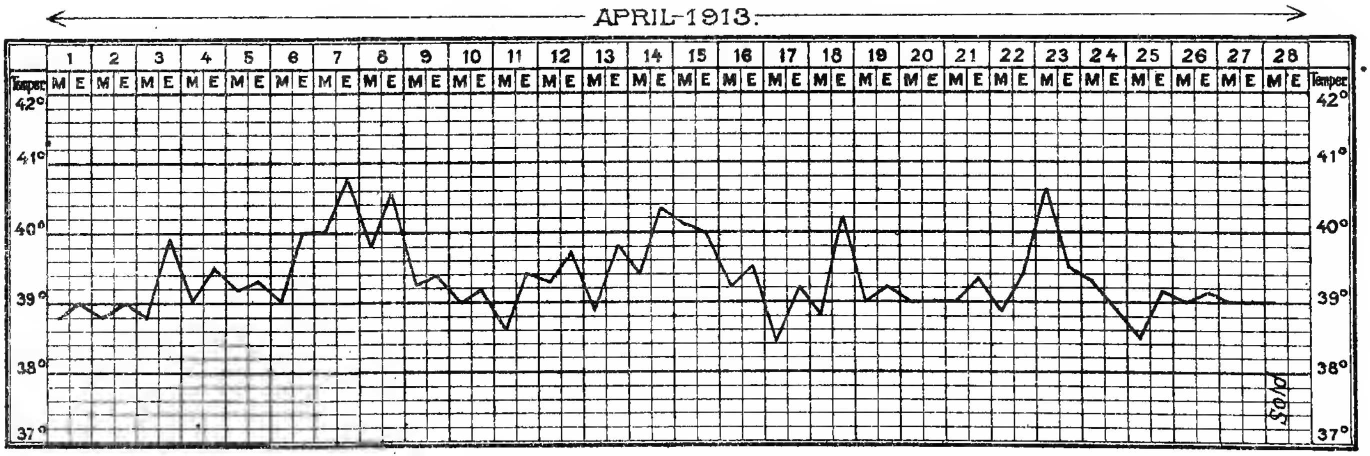
EXPERIMENT No. 128.

Hide, outer side smeared with manure and mucus from a bull suffering from Cattle Plague. It was then rolled up and kept in the shade for twenty-four hours.

Cyprus bull No. 2436 kept in contact with hide for three days.

Result.—Animal showed a temperature reaction between the twelfth and twentieth days after being placed in contact with hide. It was afterwards tested with virulent blood and found to be immune.



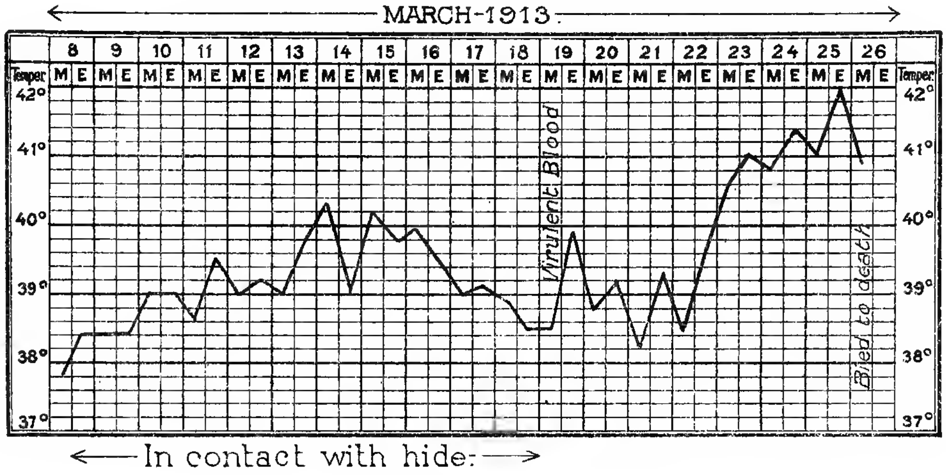


EXPERIMENT No. 134.

Hide, fresh, taken immediately after skinning from a Cyprus bull which had died of Cattle Plague.

Cyprus bull No. 2468 kept in contact with hide for ten days.

Result.—Animal showed slight temperature reaction between fifth and eighth days after being placed in contact with hide. He was afterwards tested with virulent blood and found to be susceptible.



EXPERIMENT No. 160.

Hide, folded up and put in the shade for twenty-four hours.

Cyprus bull No. 2549, kept in contact with hide for fifteen days.

Result.—Animal remained well and was afterwards tested with virulent blood and found to be susceptible.

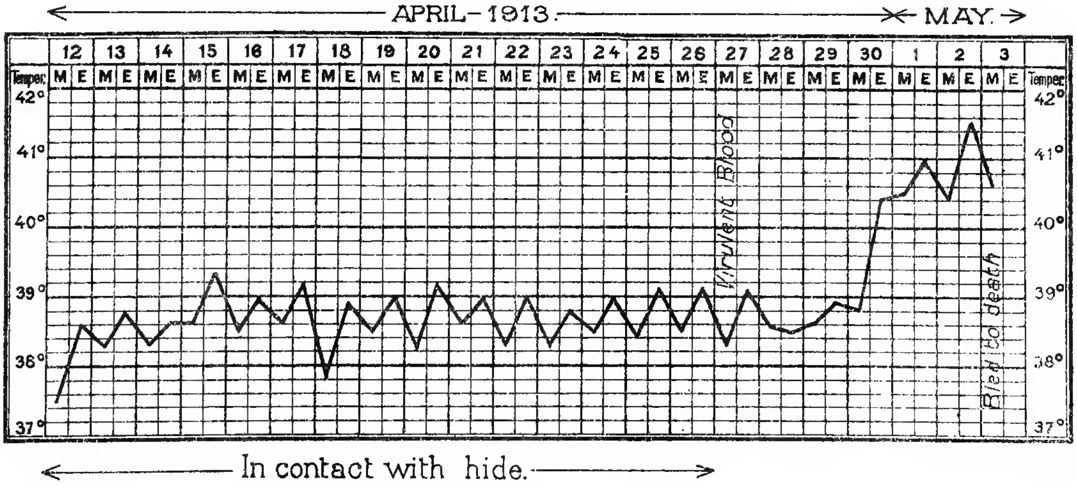


TABLE No. 29.—Experiments to determine the Infectivity of Cattle Plague Attendents.

EXPERIMENT No. 118.

On February 4, 1913, Cyprus Nos. 2404 and 2405 were isolated in one of the Commission stables and were attended by the *saice* who was in charge of the infected Cyprus cattle of the Institute, until March 25, 1913, during which time they remained normal.

On March 25, 1913, were inoculated with virulent blood and serum, and both had typical Cattle Plague charts and recovered.

Result.—Negative. Neither animal contracted the disease, although both were afterwards found to be susceptible when tested with virulent blood.

EXPERIMENT No. 144.

On March 25, 1913, Cyprus Nos. 2501 and 2502 were isolated in one of the Commission stables and attended by the *saice* in charge of the infected Cyprus cattle of the Institute, until April 6, 1913, during which time they remained normal.

On April 6, 1913, were tested with virulent blood, both had typical Cattle Plague charts, and were bled to death for virulent blood on April 13, 1913.

Post-mortem.—Cattle Plague in both cases.

Result.—Negative. Neither animal contracted the disease, although both were afterwards found to be susceptible when tested with virulent blood.

EXPERIMENT No. 158.

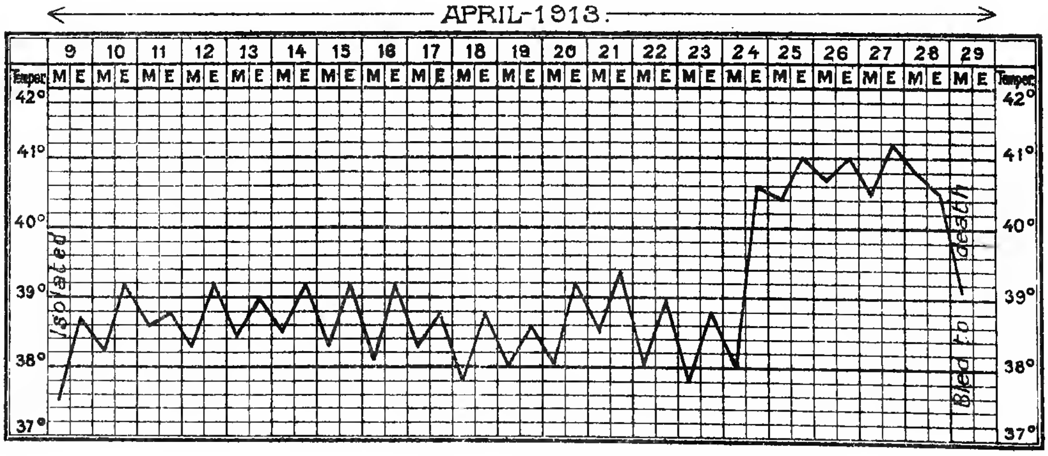
On April 9, 1913, Cyprus No. 2538 was isolated in one of the Commission stables and was attended by the *saice* in charge of the infected Cyprus animals of the Institute.

On April 24, 1913, had a rise of temperature.

On April 29, 1913, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.



On April 9, 1913, Cyprus No. 2539 was isolated in one of the Commission stables and was attended by the *saice* in charge of the infected Cyprus animals of the Institute.

On April 24, 1913, had a rise of temperature lasting for four days and followed by a period of apyrexia of six days' duration.

On May 4, 1913, was tested with virulent blood, but had obviously already contracted the disease as his temperature rose the same evening.

On May 9, 1913, died.

Post-mortem.—Cattle Plague.

Result.—Positive. Contracted the disease.

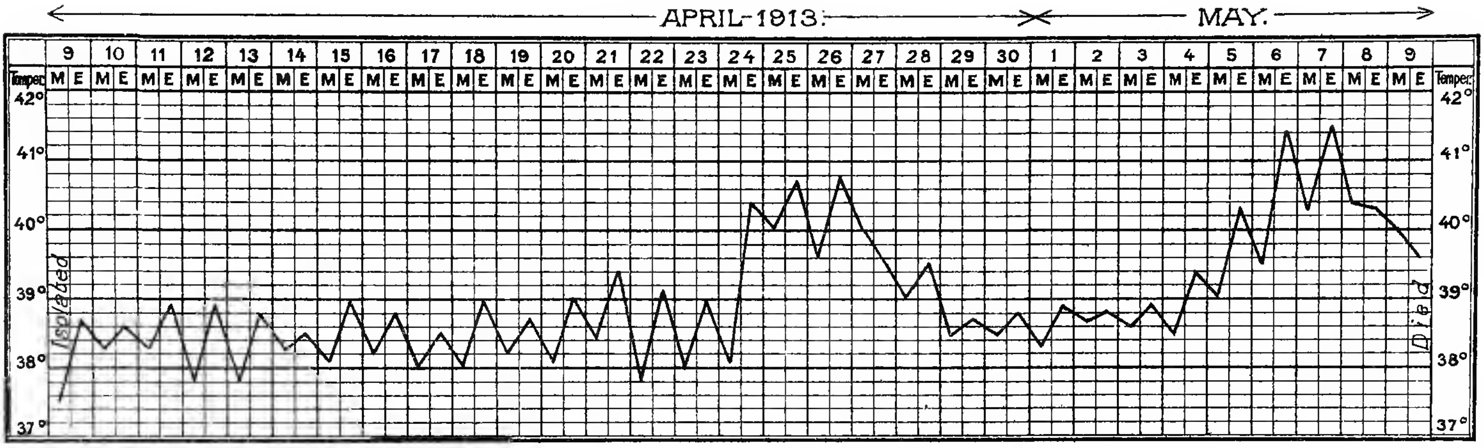


Table No. 30.—Experiments to determine the Infectivity of Goats.

Experiment No. 67.

On September 7, 1912, Egyptian goat No. 1 was inoculated subcutaneously with 1 c.c. of virulent blood.

No reaction.

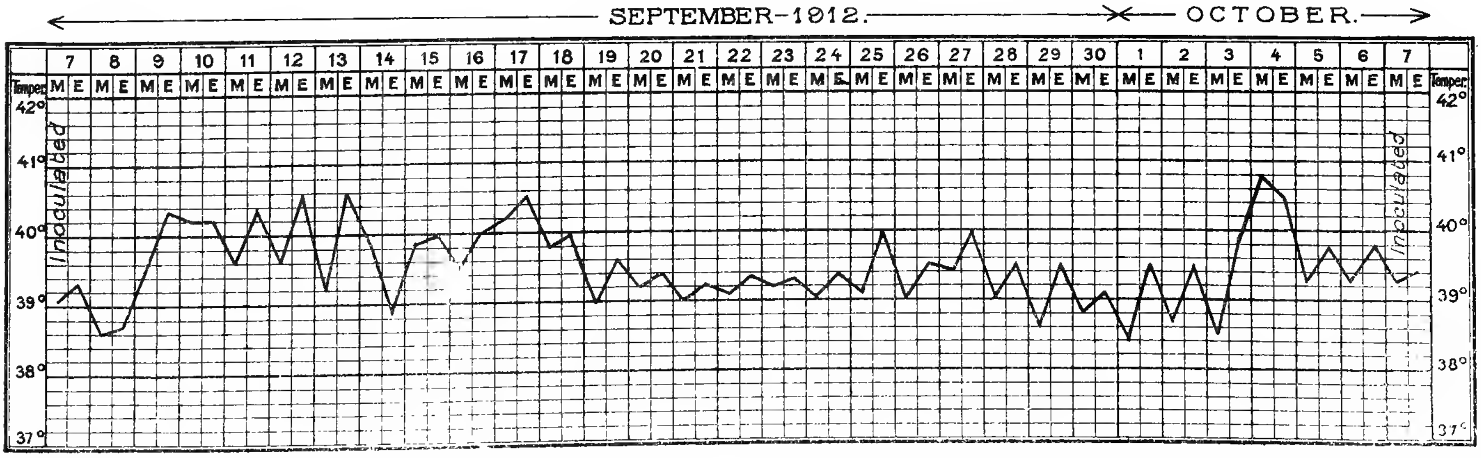
Result.—Negative. Did not contract the disease.

On September 7, 1912, Bedouin goat No. 2 was inoculated subcutaneously with 1 c.c. of virulent blood.

On September 9, 1912, had a rise of temperature and recovered.

On October 7, 1912, was again inoculated with virulent blood and showed no reaction.

Result.—Positive. Showed a definite reaction and recovered.



On September 7, 1912, Bedouin goat No. 3 was inoculated subcutaneously with 10 c.c. of virulent blood.

On September 10, 1912, had a rise of temperature.

On September 12, 1912, developed diarrhœa.

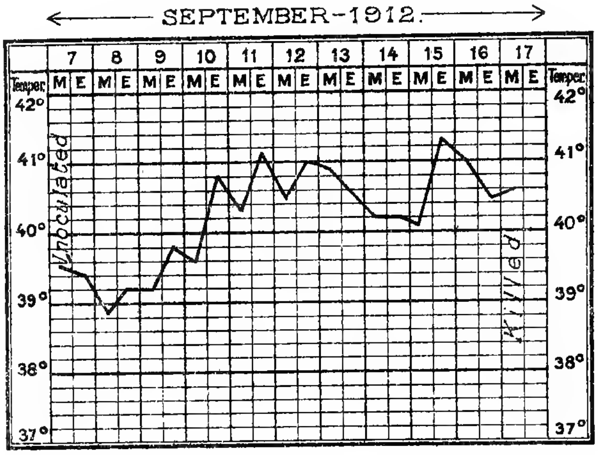
On September 15, 1912, nasal discharge.

On September 17, 1912, was killed for post-mortem examination.

Post-mortem.—No definite lesions were found. All the organs were normal with the exception of the lungs which showed some broncho-pneumonia.

Result.—Positive.—Showed a definite reaction.

N.B.—On September 14, 1912 (*i.e.* seven days after inoculation), this animal was bled from the jugular vein and 2 c.c. inoculated into a Cyprus bull, which developed typical Cattle Plague.

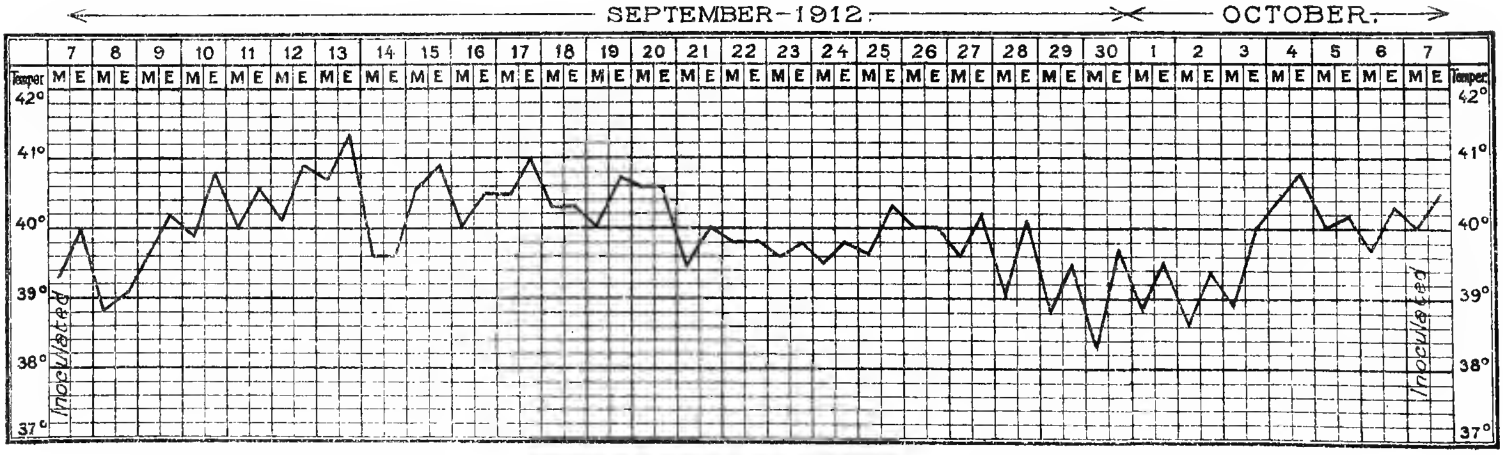


On September 7, 1912, Bedouin goat No. 4 was inoculated subcutaneously with 10 c.c. of virulent blood.

Animal showed a severe temperature reaction with nasal discharge and cough, but recovered.

On October 7, 1912, was again inoculated with virulent blood and showed no reaction.

Result.—Positive. Contracted the disease.

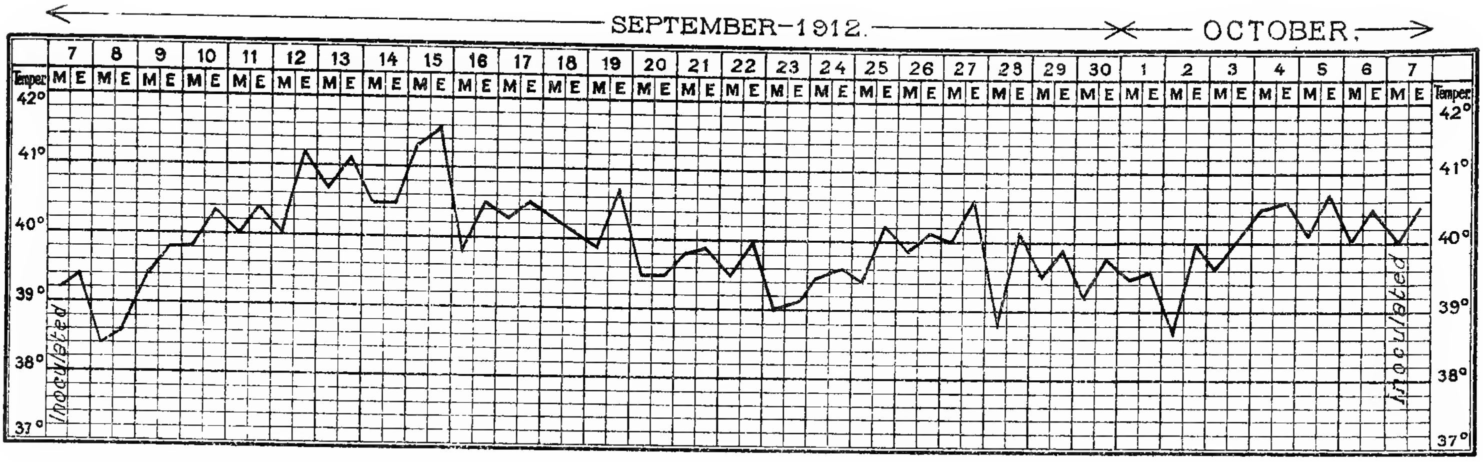


On September 7, 1912, Bedouin goat No. 5 was inoculated subcutaneously with 50 c.c. of virulent blood.

Had a severe temperature reaction with nasal discharge and cough but recovered.

On October 7, 1912, was again inoculated with virulent blood and showed no reaction.

Result.—Positive. Contracted the disease.

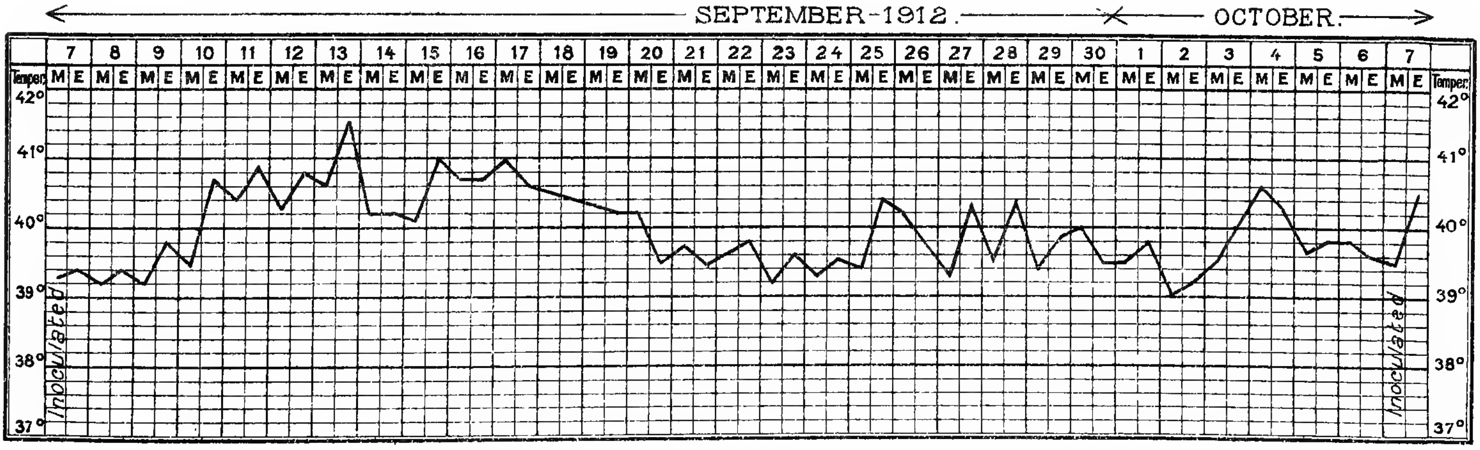


On September 7, 1912, Bedouin goat No. 6 was inoculated subcutaneously with 50 c.c. of virulent blood.

Had a severe temperature reaction, but recovered.

On October 7, 1912. was again inoculated with virulent blood and showed no reaction.

Result.—Positive. Contracted the disease.



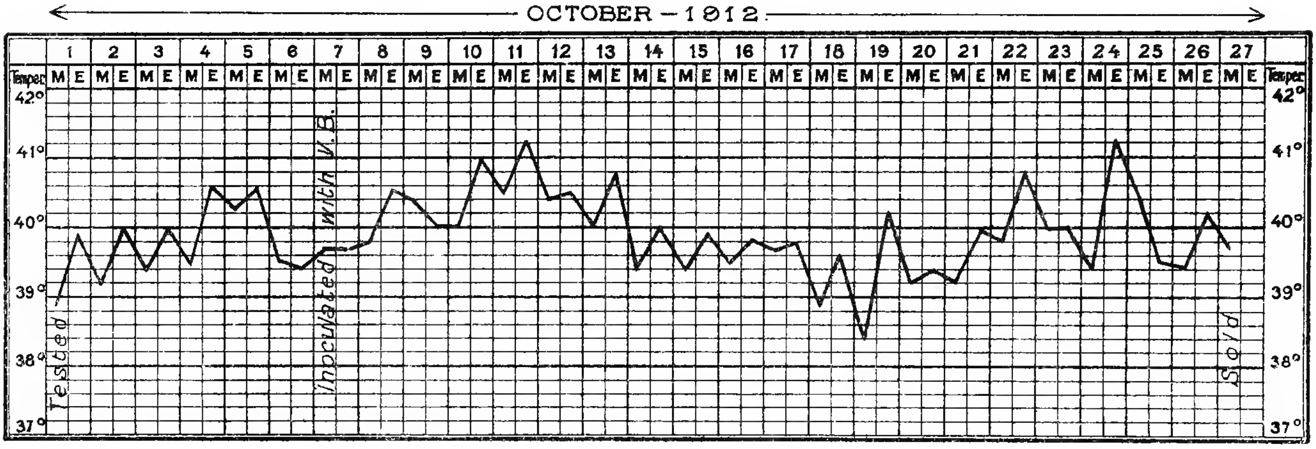
EXPERIMENT No. 81.

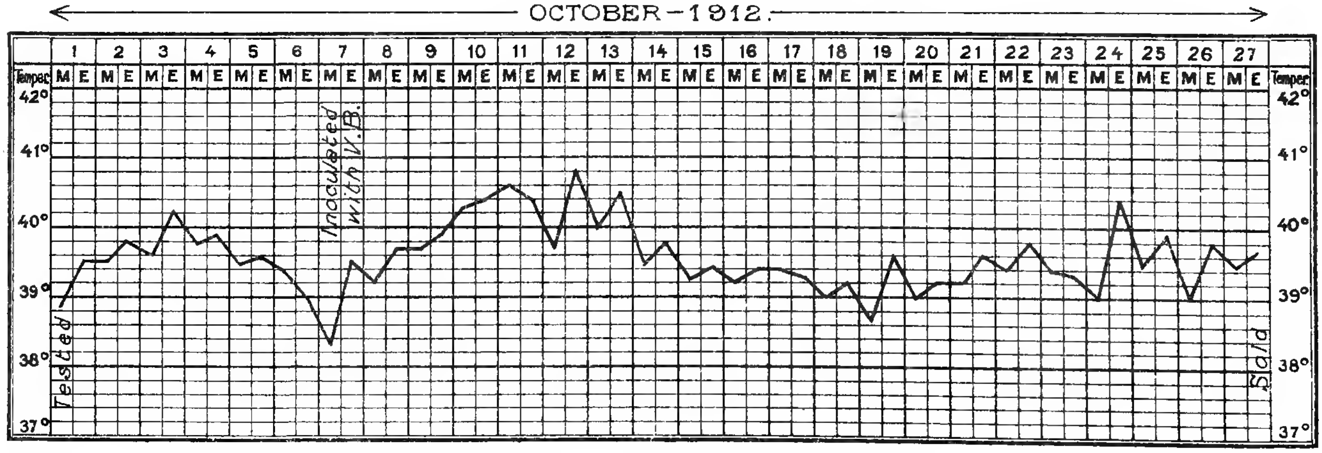
In 1912, eleven Egyptian goats, Nos. 7-17, were purchased and isolated for observation.

On October 1, 1912, they were tested for Malta Fever (agglutination test) and were all found negative.

On October 7, 1912, they were inoculated subcutaneously with 5 c.c. of virulent blood each and were isolated in the Animal Isolation Hospital.

None of the above eleven animals showed any clinical signs, but five (Nos. 8, 9, 10, 11, and 13) had a slight though apparently definite temperature reaction, beginning as a rule about three days after inoculation. The charts of the two most marked cases (goats Nos. 8 and 9) are appended.





EXPERIMENT No. 82.

On September 28, 1912, four goats, a mother and her three kids (Nos. 19–22) were purchased and isolated for observation in the Animal Isolation Hospital.

On October 1, 1912, they were tested for Malta Fever (agglutination test) and were all found negative.

On October 7, 1912, they were inoculated subcutaneously with 5 c.c. each of virulent blood.

None of these animals had any rise of temperature or other clinical signs.

EXPERIMENT No. 67*a*.

On September 14, 1912, Cyprus bull No. 2032 was placed in a loose box in the Animal Isolation Hospital with the six goats (Nos. 1–6), which were inoculated with virulent blood on October 7.

He remained in contact with these animals until October 16 without any rise of temperature or other clinical signs of illness.

On Ocotber 16, 1912, was tested with virulent blood.

On October 19, 1912, had a rise of temperature.

On October 28, 1912, died of acute Cattle Plague.

Post-mortem.—Cattle Plague.

Result.—Negative. Did not contract the disease, although afterwards found to be susceptible when tested with virulent blood.

TABLE No. 31.—**Contact Experiments.**

In these experiments either naturally recovering animals were used or when such were not available animals were inoculated with virulent blood and the necessary dose of serum to insure their recovery. At different periods susceptible animals were placed in contact with them.

EXPERIMENT No. 129.

On March 3, 1913, Cyprus No. 2448 was put in contact with Cyprus No. 2402 and fed and watered from the same manger and bucket. Isolated together in the Commission stable No. 2.

From March 3 to 13, 1913, remained normal.

On March 13, 1913, was tested with virulent blood.

On March 16, 1913, had a rise of temperature.

On March 19, 1913, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Negative. Did not contract the disease, although afterwards found to be susceptible when tested with virulent blood.

N.B.—Cyprus No. 2402 had received no serum, but was recovering from Cattle Plague, the result of virulent blood given by the mouth (*see* Experiment No. 121). At the time of the experiment he had had a normal temperature for eight days, but there was still some discharge from the nose.

EXPERIMENT NO, 147.

On March 26, 1913, Cyprus No. 2511 was placed in contact with Cyprus No. 2435, an animal recovering from Cattle Plague whose temperature had been normal for two days.
From March 26 to April 20, 1913, remained normal.
On April 20, 1913, was tested with virulent blood.
On April 22, 1913, had a rise of temperature.
On April 26, 1913, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Negative. Did not contract the disease, although afterwards found to be susceptible when tested with virulent blood.

EXPERIMENT NO. 152.

On April 5, 1913, Cyprus No. 2527 was placed in contact with Cyprus Nos. 2404 and 2405, two animals which had been simultaneously inoculated eleven days previously and whose temperature had been normal for four days.
From April 5 to 20, 1913, remained normal.
On April 20, 1913, was tested with virulent blood.
On April 23, 1913, had a rise of temperature.
On April 26, 1913, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Negative. Did not contract the disease, although afterwards found to be susceptible when tested with virulent blood.

EXPERIMENT NO. 178.

On May 2, 1913, Cyprus No. 2614 was placed in contact with Cyprus Nos. 2581 and 2584, whose temperature had just returned to normal after simultaneous inoculation.
From May 2 to 13, 1913, remained normal.
On May 13, 1913, was tested with virulent blood.
On May 16, 1913, had a rise of temperature.
On May 19, 1913, was bled to death for virulent blood.

Post-mortem.—Cattle Plague.

Result.—Negative. Did not contract the disease, although afterwards found to be susceptible when tested with virulent blood.

TABLE NO. 32.—**Contact Experiments.**

The details of these experiments have been given in Table No. 32, pages 39 and 40, of the report.
There is nothing special to note in the individual experiments.

7.—APPENDIX.

At the first meeting of the Cattle Plague Commission held in April 1912, two members of the Commission were asked to institute certain experiments in connection with the disease, and the Commission was of the opinion that the investigations should be directed, at any rate in the first instance, to certain points having an important bearing on the practical measures necessary for dealing with the epidemic; and various members suggested questions which in their opinion urgently called for investigation in this connection.

A large amount of experimental work has now been carried out and will be embodied in a report, which is in course of preparation. In the meantime, however, the following is a brief abstract of the results obtained, so far as they bear on the specific questions suggested by the Commission:—

(1) *Does Cattle Plague exist in such benign form amongst the Egyptian and Sudanese cattle that it cannot be clinically diagnosed, and are "gamoos" more especially subject to this form of the disease, so becoming "carriers" of the contagion and playing an important rôle in carrying on the disease?*

The susceptibility of Egyptian animals to Cattle Plague shows every grade, from high susceptibility to absolute immunity, and the disease may exist in some animals in such a benign form that it gives rise to no symptoms other than a slight rise of temperature.

As regards the *gamoos*, the general experience in Egypt is, that while the *gamoos* may contract Cattle Plague and even die of the disease, this animal is very much less susceptible than the cattle of the country. Very often in infected villages the *gamoos* apparently escape altogether. If they are affected they commonly have a benign form of the disease, though at times acute cases occur. As it was almost impossible to obtain *gamoos* known with certainty never to have been in contact with Cattle Plague, *gamoos* calves were used so as to minimise this risk, and a number of these were inoculated with virulent blood. Of nine of these animals, eight showed no reaction, but in the ninth the temperature was very irregular between the sixth and the tenth day after inoculation, and blood taken on the eleventh day gave the disease to a susceptible bull.

This result agrees with that found in experiments made before the formation of the Commission. In these experiments thirteen *gamoos* calves were inoculated with quantities of virulent blood varying from 1/10th c.c. to 350 c.c. One animal died from Cattle Plague, and of the remaining twelve none showed any clinical symptoms, though some had a slight rise of temperature, generally after an incubation period of from three to five days.

There is therefore no doubt that, although the *gamoos* enjoys, as a rule, a considerable degree of natural immunity, susceptible individuals exist, and these can contract Cattle Plague and act as transmitters of the disease.

How large a percentage of these susceptible animals exists could only be determined by the inoculation of large numbers of *gamoos* in different districts.

(2) *The natural means of conveyance of the infection. Infectivity of nasal discharge, urine, dung, meat, hides, etc.*

Infectivity of Nasal Discharge.—This was found to be most highly infective. Of twenty-four animals whose nostrils were swabbed with nasal mucus, especially with a view to determining the infectivity of this secretion, twenty-two developed the disease after an incubation period of from two and a half to five and a half days. Of the remaining two, one developed the disease after the nostrils were again swabbed with nasal discharge, and the other on inoculation proved to be immune. As a matter of fact the question of the infectivity of the nasal secretions left no possible doubt, and the method of "nose-to-nose" infection has been used for years in the routine work of the Serum Institute.

Merely smearing the conjunctivæ with this discharge is sufficient to infect a healthy animal.

Dung, containing as it does the highly virulent discharges from the mucous membrane of the gut, is naturally infective, and most writers appear to attach considerable importance to this in connection with the infectivity of stables and manure.

In Egypt, owing to the comparatively high temperature and relative dryness of the air, dung, unless absolutely fresh, probably plays no important rôle in the transmission of the infection. Attempts to infect an animal by feeding on *tibn* mixed with Cattle Plague dung, which had been dried for twenty-four hours in the shade, were quite negative, although the feeding with infected material was repeated.

Blood, Meat, and Hides.—The most outstanding result so far obtained and one which has a most important bearing on any regulations framed for dealing with the disease is the fact that the blood of sick animals, though highly virulent when injected subcutaneously, appears to be incapable of transmitting the disease by ordinary methods of infection—at any rate in small doses. The nostrils of a considerable number of highly susceptible cattle have been smeared with virulent blood and in no case has infection taken place, except in two animals, whose nostrils were intentionally very liberally smeared; in these cases a certain amount of blood was undoubtedly swallowed.

This being the case, it is obvious that, for ordinary practical purposes, Cattle Plague meat may be disregarded as a means of spreading the disease. This refers only to the meat proper, and not to the viscera, for it has been found that scrapings from the mucous membrane lining the stomach, and emulsions of the liver, spleen, etc., readily transmit the disease by the ordinary methods of contact.

In the same way hides of animals sick of Cattle Plague are not infective in virtue of the blood which they contain, but only by means of the infective secretions with which they may be externally contaminated. Thus it has been found that the hides of animals killed on the sixth day do not convey the disease, whereas the hides of animals which have died of Cattle Plague and which are frequently smeared with infective secretions may, but do not invariably, transmit the disease.

In these experiments the skin to be tested was placed on the ground under a susceptible animal; he was fed directly off the hide, which was left under him for two days, so that he had every possible chance of contracting the disease.

The fact that Cattle Plague hides are not virulent in virtue of the blood which they contain, but only by means of the infective secretions with which they may be externally contaminated, has a very important bearing on the practical question of their disinfection, as it is only necessary for the disinfectant to attack these secretions, and there is no necessity that it should penetrate into the substance of the hide.

Virulent blood appears to infect somewhat easily by the alimentary canal—when given in the form of a drench the minimum dose is about 1 c.c.—though it does not invariably infect at 5 c.c.

As regards infection by means of the air, this appears to play no part in the transference of the disease. A special stable was constructed and divided into two by a partition consisting of two layers of wire-netting one metre apart. A susceptible Cyprus animal was kept on one side of the partition and the other side was occupied by infected cattle. The susceptible animal remained in this stable for a month, during which time three different infected animals were successively placed on the other side of the partition, and one was allowed to die in the stable. No infection resulted. This experiment has been repeated with the same result.

(3) *The times of incubation of the disease in different classes of cattle (gamoos, etc.).*

The period of incubation of the disease in highly susceptible cattle, after infection through the nostrils, was found to vary from two and a half to five and a half days.

As regards the *gamoos*, no definite data are available, owing to the difficulty in obtaining animals of known susceptibility. From the limited information at our disposal, the incubation period would appear to be practically the same as in the case of the bull.

(4) *How long does the meat (fresh and frozen) of an infected animal remain infective?*

As in the case of blood, Cattle Plague meat is not infective in the ordinary sense of the expression, though an emulsion of the meat, when injected subcutaneously, will give the disease.

Meat hung and kept under ordinary conditions, at temperatures of 13° C. and 28° C., for periods up to forty-eight hours, when emulsified and injected into susceptible animals, gave the disease.

Experiments made with Cattle Plague meat kept under Cold Storage conditions, at –6° C. to –7° C., showed that the longest period of storage after which the meat was virulent was thirteen days, but the loss of virulence may take place earlier, as in one case it was found to be non-virulent after one week.

It would appear from this that the risk of the transmission of the disease to other countries by the export of frozen meat need not be seriously taken into consideration, more especially when one considers that the juice of the meat is not infective by mere contact.

(5) *How long does the hide of an infected animal remain infective under various circumstances (e.g. when dried, salted, etc.) and what are the best methods of disinfecting hides?*

As already stated in dealing with question No. 2, the hides of Cattle Plague animals are only infective in virtue of the infective secretions with which they may be externally contaminated.

A considerable number of experiments have been made with hides treated by drying, salting, etc., and in no case has it been found possible to infect an animal with a hide which has been dried or salted for forty-eight hours.

(6) *How long does an animal remain infective after recovery from the naturally acquired disease?*

As naturally infected animals were not available, this question could not be dealt with. There is, however, no reason to believe that the disappearance of the infection in the naturally infected animals in any way differs from the disappearance of the infection in those simultaneously inoculated.

(7) *How long does an animal remain infective after simultaneous inoculation?*

It would appear that as a general rule simultaneously inoculated animals are not infective after the temperature has returned to normal. Exceptions may possibly be found later, but, up to the present, susceptible Cyprus cattle placed in contact with simultaneously inoculated animals, eight, four, and two days and immediately after the subsidence of the fever did not contract the disease.

(8) *The duration of passive immunity after injection of serum and its relation to the dose of serum injected.*

Egyptian animals have been inoculated with different amounts of serum and then placed amongst infected cattle with a view to seeing how soon they contract the disease.

Many of these Egyptian animals, being already completely immune to Cattle Plague, naturally escaped altogether. Other animals, highly, but not absolutely, immune, contracted very mild attacks, hardly noticeable except by a slight rise of temperature. More susceptible animals showed more marked reaction, whilst highly susceptible animals contracted the disease comparatively early and behaved as if they had been simultaneously inoculated. These latter animals only concern us, but as they exist only in a small proportion amongst Egyptian cattle, and as there is no means of recognising them before they are inoculated, the experiments have had to be made with Cyprus animals. These animals are, however, subject to Texas and Egyptian fevers and considerable difficulty was met with from these complications.

Holmes, working in India, where this difficulty is not encountered and where highly susceptible cattle can be easily obtained, found that:—

One dose of serum protects for about two weeks.

Two doses of serum protect for about three weeks.

Three doses of serum protect for about five weeks.

Four doses of serum protect for about six weeks.

In view of the unfavourable opinion of all the members of the Commission on the "serum-alone" method for dealing with the disease in Egypt, these experiments were discontinued.

(9) *If an animal is repeatedly injected with serum, do the injections become useless or even harmful?*

Experiments made by repeatedly injecting cattle with large doses of serum show that the injections do not become useless nor harmful. These results agree with those obtained by Ruediger in the Philippines.

(10) *On the duration of infection in stables (on dried tibn), etc.*

A considerable number of experiments have been made by placing susceptible Cyprus cattle in highly infected stables, after these stables have stood empty for varying periods of time.

So far, there has been no evidence that a stable from which an animal suffering from Cattle Plague has been removed is highly infective. Susceptible animals placed in such stables as a rule have not contracted the disease; though this may occur, being in such cases probably due to the animal coming in contact with some of the fresh discharges.

The same holds good in the case of infected forage, and in one case a susceptible animal was fed on three separate occasions with freshly infected *tibn* without result. He was then fed for six days with the *tibn* taken from the mangers of the acutely infected Cyprus cattle, but did not contract the disease. Experiments also tend to show that infection by drinking from contaminated water does not take place so easily as has been supposed.

As regards the spread of Cattle Plague, there is no doubt that an animal sick of Cattle Plague is infective, mainly if not exclusively in virtue of the highly infective discharges from the nose, mouth, gut, etc. As the virus is, however, somewhat rapidly destroyed by desiccation and putrefaction, under ordinary circumstances these discharges rapidly lose their infective character. The sick animal, on the other hand, is a continual source of these infective discharges, and it is to such sick animals that attention must be directed in dealing with the disease.

In connection with the infectivity of stables, it was shown that when a susceptible animal is placed in a stable which has recently been vacated by an animal sick of the disease, infection does not as a rule take place, even although the infected manure, fodder, etc., have not been removed. If, however, the susceptible animal is placed in a stable which actually contains a sick animal, infection invariably takes place.

Indeed, there can be no possible doubt that the most important fact in the spread of the disease is the part played by actual "animal to animal" infection.

As a general rule, the direct transference of the infection from ox to ox is probably sufficient to explain the spread of the disease, but under certain circumstances it is quite possible that other susceptible animals, such as the sheep, goat, or buffalo, may also be concerned.

In view of the considerable mortality from Texas fever, which has followed the simultaneous inoculations in certain districts during the past year, attention is at present being devoted to this point.

March 19, 1914.

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